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London: Hachette & Cie., 16-17 King William Street, Charing Cross, W.C.2

Paris: Hachette & Cie., 111 Rue Reaumur

Melbourne: Gordon & Gotch 509-513 Little Collins St.

ISSUED MONTHLY — SUBSCRIPTION: — SINGLE COPY, 25 CENTS

In United States and its possessions, also Canada, Cuba, and Mexico, per year, postpaid - $2.50

To all other countries in the Postal Union - - - - - - - - - - - 3.00

All subscriptions are discontinued at expiration. Please examine the date printed on your wrapper.

Entered as Second Class Matter Sept. 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3rd, 1879.
Entered as Second Class Matter at the Post Office Department, Canada.

Published monthly by POPULAR MECHANICS CO. Copyright, 1925, by Popular Mechanics Co. Copyright in Australia. Copyright in France

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Vol. 43 FEBRUARY, 1925 No. 2

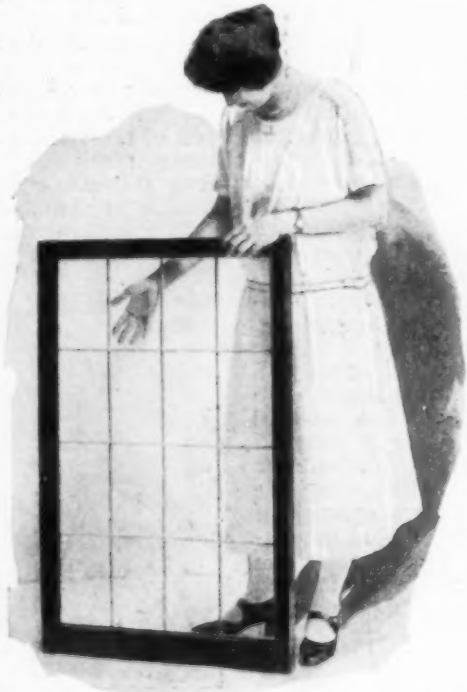
The Sun as Your Doctor

Clear Quartz Windows Promise to Cure Diseases Caused by Lack of Ultraviolet Rays in Filtered Sunlight

ANNOUNCEMENT recently that a way has been found to produce clear fused quartz glass in commercial quantities at a reasonable cost, followed by word that Johns Hopkins hospital had installed the world's first quartz window, disclosed a new chapter in the use of natural agencies to fight disease.

The value of clear fused quartz lies in the fact that it affords ready passage to the ultraviolet rays which glass turns back. It is the absence of ultraviolet rays that causes children kept indoors in wintry climates to develop rickets and other diseases. Besides the seven colors of the spectrum — red, orange, yellow, green, blue, indigo and violet — sunlight contains another "color" which is not visible to the eye, and which lies beyond the violet range of the spectrum. This is known as ultraviolet. Not only are the eyes insensible to its presence, but the pigment in the skin is ordinarily proof against it. When the unpigmented portions of the skin are exposed to the ultraviolet rays sunburn develops. In the extremely rare cases known to science where people have been born without any pigment in the skin, it has been necessary to keep them out of the sun to save their lives. Ordinary window glass is opaque to ultraviolet rays, and now science has discovered that to this fact rickets, a disease of undeveloped bones in children, is due.

The discovery was made by Dr. William T. Bovie, professor of bio-physics at Harvard university, with the co-operation of President C. C. Little, of the University of Maine. They used chickens for the experiment, and produced ultraviolet rays with an ordinary mercury lamp, using a quartz globe. Two chickens were raised in a greenhouse, under the same conditions, with identical food, the same dust bath, and the same-size pens. The common glass of the greenhouse kept out the ultraviolet rays. One chicken was exposed to the rays of the mercury lamp for fifteen minutes each day. It developed much faster than its unexposed mate, and at the end of the experiment X-rays showed the bigger chicken had well-developed bones, with plenty of calcium and phosphorus salts in them, while the small chicken had poor bone structure, and died shortly after the pictures were taken. The chicken exposed to the rays for fifteen minutes a day also showed

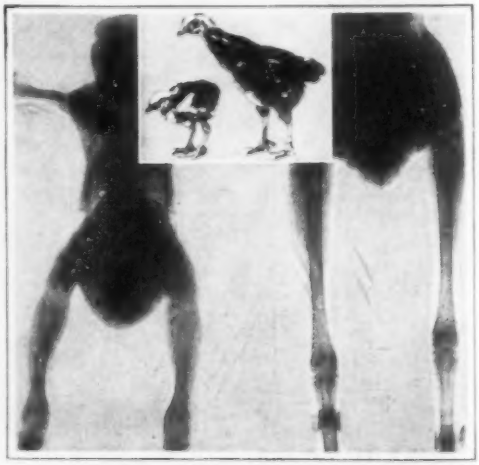


Window of Fused Quartz, the First of Its Kind, Which Has Been Built for a Hospital

Exposure under Ultraviolet Rays from Quartz Lamp Made Bigger Chicken Outstrip Mate

better development and weighed more than chickens of the same brood which had been permitted to run at large under natural sunlight. That fact has raised the interesting question of whether longer exposure to the rays might cause the bones to develop too fast, and hence produce a dwarf chicken. Scientists believe the experiment indicates that the prevalence of pigmy races in the tropics, with their development to maturity taking place much earlier in life than in more temperate climes, may be due to an excess of ultraviolet rays from the intense tropical sunlight. In its application to humans, as planned at Johns Hopkins hospital, the new quartz glass is expected to open a new field of therapeutic treatments. The formation of the bones, which is affected by the rays, involves a series of chemical changes which physiologists call "calcium metabolism." Besides rickets, there are other diseases caused by the absence of calcium, such as otosclerosis, or hardening of the eardrum, and osteomalacia, a chronic progressive adult disease marked by softening of the bones. A bowlegged child is a victim of rickets.

"The disease records of every city," Dr. Bovie said in announcing his discovery, "show that from ninety-seven to one hundred per cent of all the babies raised in the northern countries, where it is necessary to keep children indoors and to use window glass to shut out the cold, have rickets when examined in the spring. Undoubtedly many other physiological processes are involved. We may expect to find the same factors influencing the growth rate of children as have been found in this experiment with the chickens. The results of the experiments are of great economic value because it is a common experience of chicken growers that the death rate of chickens at the age of four and five weeks is very high. The experiments show that this death rate can be reduced by supplying ultraviolet light to the chickens. Chickens receiving this treatment are not only larger, but are livelier and more vigorous in every way than are those which did not receive it. The secondary sex characters did not develop in the chickens which were deprived of the ultraviolet light. These characters were fully, if not excessively, developed in the chickens which did receive the ultraviolet radiation. It should be added that the illustrations do not tell the whole story because all of those chickens in the group treated with ultraviolet light lived, except a few killed by rats. About seventy-five per cent of the chickens from the pen of the smaller chick pictured, that is, those receiving filtered sunlight, died from a disease known as 'weak legs.' This disease in mankind is called rickets."



The Two Chicks at Age of Four Weeks, and X-Ray Showing Better Bone Development of the Larger

Halted at Water's Edge, Canoe That Has Served as Sidecar Is Quickly Launched from Motorcycle without Disturbing Passenger

Canoe as Sidecar for Motorcycle Is Detached for Floating

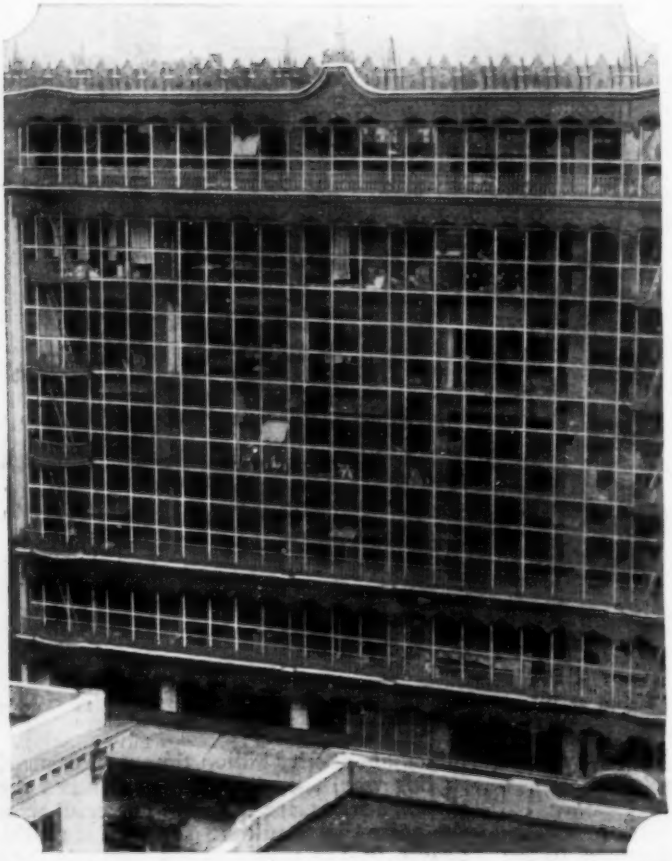
A motorcycle exhibited during a London exposition has a canoe fastened to the frame like a sidecar, which can be dismounted from the wheel and launched in forty seconds. The craft is held in place by a series of straps which may be quickly loosened. After a cruise on the water, the lightly made boat can be set on the cycle frame and used as a comfortable compartment for one or two passengers. For long overland trips, the boat may serve as a carrier for provisions and other materials as well as a roomy seat for the occupant. Although the canoe is fourteen feet long, it does not interfere with the handling of the motorcycle.

Voice Amplified Fifty Billion Times through Radio Microphone

Power of the human voice in loud speech or song is estimated at only one one-hundred-millionth of a watt. A radio-broadcasting station using 500 watts, "steps" this sound up to the equivalent of almost a full "horsepower voice," which means that the original tone has been amplified about fifty billion times. Measured in this way, the vibrations that leave the station's wires, are far more powerful than the noise that would be produced if all the people in the world could unite in one mighty shout.

Sources of Platinum Ore

Platinum ore and its associated metals, contrary to popular impression, are widely distributed over the earth, but thus far have been worked in paying quantities in only a few regions. More than ninety per cent of the world's supply has come from the Ural mountains, but conditions in Russia in recent years have almost closed this source. Next to Russia, Colombia, in South America, which also produces most of the world's emeralds, is the biggest producer of platinum. Traces of the ore have been found in California, Oregon, Alaska, Canada and Mexico, and in Brazil and other parts of South America, as well as Australia, Tasmania, Dutch East Indies and Papua. Crude platinum is usually found in the form of rounded or flattened grains of "sand," occasionally in irregular lumps the size of a pea, and but seldom in nuggets, though one has been discovered weighing twenty-one pounds.



Like One Big Window with Many Panes, This Store Front Affords Excellent Light and Show Space on Every Floor

Entire Store Front Built of Glass Provides Better Light

Modern building construction, whereby the outer walls of a steel and concrete building are carried by the pillars, and serve no purpose except to inclose the structure, has made possible a remarkable department-store front in the far west. It is of glass, with the exception of three rows of ornamental trim. The unusual front not only admits more daylight, but makes possible window displays on the upper floors.

Whole World Contributes Material for Making Electric Lamps

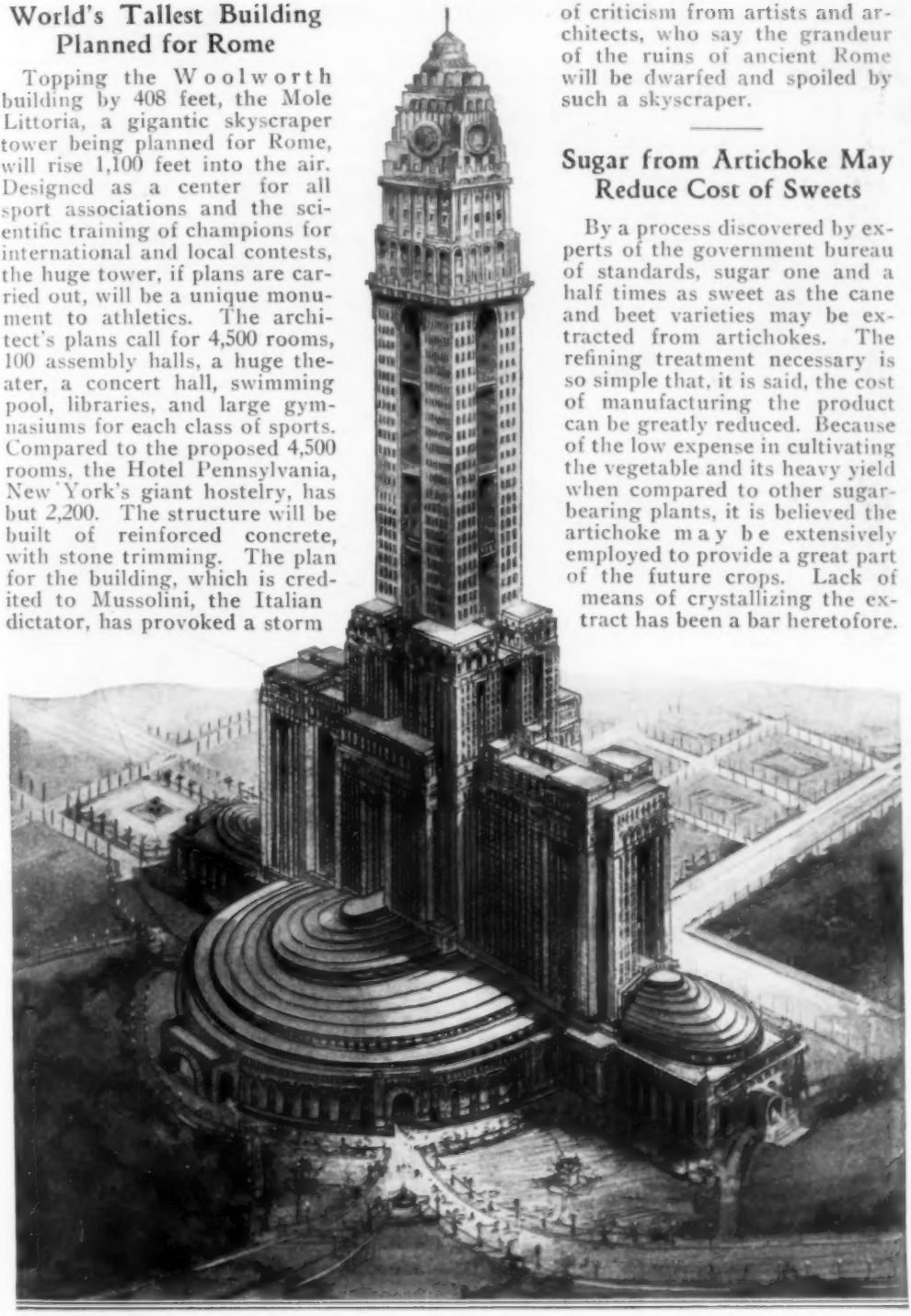
Ships must sail the seven seas to gather materials for the 1,000,000 electric lamps that the United States uses every day. In the simple-looking filament, bulb and base, countries from Greenland to Australia and from Europe to Africa are represented. The tungsten is mined in China, Norway or in Australian mountains. Before it becomes the little coil that glows in the dark, it must be drawn through diamond dies made from stones found in South Africa, Brazil or even the United States. Phosphorus and cryolite which counteract the gases that may be formed inside the bulb come from Canada and Greenland. The molybdenum wires that support the filament at top and bottom are obtained from metals found in Australia, China and Spain and nickel for the base wires comes from Canada. Tin for soldering the connections at the base is found in Cornwall or in the mines north of Singapore and the heat deflector is made from white mica from India. South America and the United States contribute copper for the wires leading to the electric switch. Canadian asbestos, French ocher and wax from South America insulate them and protecting material is also made from rice paper brought from Japan, "kraft" paper from Sweden and burlap from Scotland.

Vanishing Handle on Traveling Bag Protects Owner against Theft

As a safeguard against theft of luggage, steel loops for the traveling-bag handle that permit it to be swung down and locked securely inside when the grip is closed, have been placed on the market. They can be fitted to any style of bag in a few minutes and are said to be stronger than the fastenings usually furnished with equipment of this kind.

World's Tallest Building Planned for Rome

Topping the Woolworth building by 408 feet, the Mole Littoria, a gigantic skyscraper tower being planned for Rome, will rise 1,100 feet into the air. Designed as a center for all sport associations and the scientific training of champions for international and local contests, the huge tower, if plans are carried out, will be a unique monument to athletics. The architect's plans call for 4,500 rooms, 100 assembly halls, a huge theater, a concert hall, swimming pool, libraries, and large gymnasiums for each class of sports. Compared to the proposed 4,500 rooms, the Hotel Pennsylvania, New York's giant hostelry, has but 2,200. The structure will be built of reinforced concrete, with stone trimming. The plan for the building, which is credited to Mussolini, the Italian dictator, has provoked a storm of criticism from artists and architects, who say the grandeur of the ruins of ancient Rome will be dwarfed and spoiled by such a skyscraper.

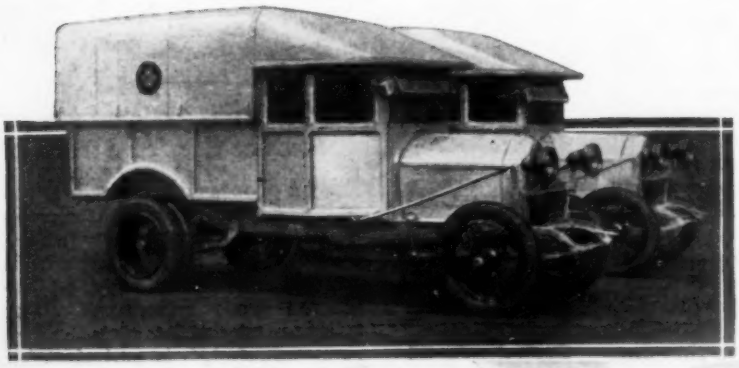


Architect's Design of Lofty Skyscraper Mussolini Plans for Rome; Motifs of Both the Coliseum and the Modern Tower Are Combined in the Structure Which Is Intended as an Exhibition, Training and Living Center for Sports Associations and Athletes

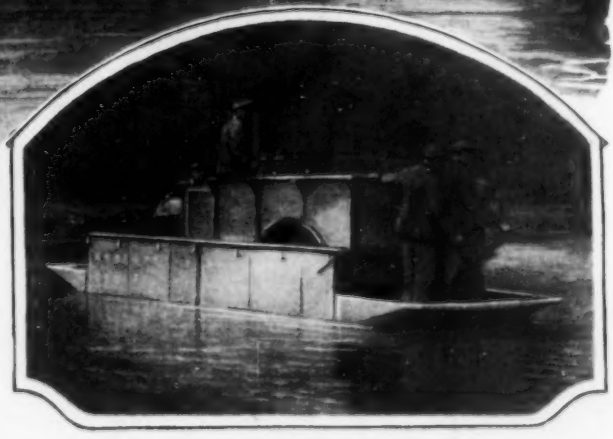
Sugar from Artichoke May Reduce Cost of Sweets

By a process discovered by experts of the government bureau of standards, sugar one and a half times as sweet as the cane and beet varieties may be extracted from artichokes. The refining treatment necessary is so simple that, it is said, the cost of manufacturing the product can be greatly reduced. Because of the low expense in cultivating the vegetable and its heavy yield when compared to other sugar-bearing plants, it is believed the artichoke may be extensively employed to provide a great part of the future crops. Lack of means of crystallizing the extract has been a bar heretofore.

AUTO TOPS MAKE FERRYBOATS FOR EXPLORERS



Motor Transports for the African Expedition with Metal Tops in Normal Traveling Position; Putting the Boat Together, and Ferrying a Car over a Stream in It; Double-Tired Rear Wheels, Wire Spokes Throughout and Capacious Drinking-Water Tanks Are Included in Equipment to Aid in Blazing 7,000-Mile Motor Trail through Wilderness



Motor conquest of the wilds of Africa is contemplated in an expedition of English explorers, setting out from Capetown with Cairo, Egypt, 7,000 miles away, as their objective. The purpose of the journey is to determine if automobile roads can be built through the wildernesses as feeders for existing railway lines. In order that they may cross lakes and streams the cars have been constructed with metal tops that may be detached and bolted together to form pontoons on which one automobile at a time can be ferried over. The sloping ends of the boat permit running them well up on the banks so that a machine can cross the bridge with little difficulty under its own power. Other equipment for the journey includes mosquito-proof netting for all openings of the cars and specially large drinking-water tanks for the long treks over barren wastes. At times, the party, which is led by Maj. C. Court-Treatt, will be thousands of miles from civilization and will be left to their own resources.

How Floating Islands Are Formed

Floating islands are not fantasies from the pens of imaginative fiction writers but scientific facts as real as anything in nature and sometimes capable of blocking

rivers. They are formed by accumulations of soil and various growths about reeds and grasses that push their way over the normal bank line of streams and oceans. When high water comes, the floating mass rises, and if the pull is strong enough, breaks away from the main land. One of these wandering islands, or "rafts" as they are called, in less than forty years became ten miles long, 600 feet wide and eight feet thick in a lower area of the Mississippi river and required four years of labor before it was removed. Another blocked the channel of the Red river for about forty-five miles.

Thousands of Player-Piano Rolls Made from Master Record

Perforating strips of paper so that when placed upon player pianos, they will reproduce with startling fidelity the touch and expression of skilled musicians, is a mechanical marvel of the modern musical age. In one large factory, with a capacity of 30,000 records a day, a pneumatic machine is used that makes 128 duplicate rolls at once. The paper passes from the reels at the rate of 170 feet a minute, receiving punctures from batteries of small punches. These are operated by compressed air, the different bars striking with a quick downward motion that sends them through sixteen thicknesses of paper. They are moved as a master handmade record passes over a diaphragm like the one on the player piano itself. The master roll really "plays" itself upon every one of the 128 strips of paper. Instead of the music made by the hammers striking the strings, the sound is the steady drone of the punches as they bore through the paper under seventy pounds' air pressure. The words are then put on the record. This is done by a single impression from a stamper bar, thirty-six feet long, set with rubber type, arranged in proper order and glued to metal slides that can be removed in an instant. One turn of the bar inks the letters from a long pad; another sends them forcibly against the paper. Thirty-two records a minute is the capacity of this machine. The strips are then spooled, labeled, tagged and inspected, and boxed for shipment.

The master records are punched by special apparatus as the musician himself

At Work on Master Player-Piano Record with Musical Score as Copy Guide

plays the keys or are copied from the score by experts. They receive many alterations and corrections before they are finally released, and are made on heavier paper than the others, and larger. Thousands of duplicates can be taken from a single original.

Defects in Speech Are Used as Clue to Diagnosis of Disease

By recording the vibrations of a patient's voice on a strip of smoked paper on a revolving drum, physicians in an English hospital endeavor to diagnose certain nervous diseases and determine methods of treatment. The theory is that various defects in the speech indicate corresponding ailments in the nervous system. These peculiarities of the voice or pronunciation are recorded on the paper, the vibrations being registered in an irregular line. The method is said to have proved valuable in paralytic and epileptic cases.

When Dictating May Reveal Disease; Talking into Voice-Vibration Recording Apparatus in Hospital

Assembling-Bench, Where Jointed Bamboo Rods Are Fitted with Grips and Reel Seats

Inspecting and Adjusting Reels before Mounting on Rods

Machines Which Set Tiny Screws into Ready-Drilled Holes

Glass Eyes for the Wooden Minnows Are Put on Like Tacks

Keeping Anglers Supplied with Fish Lures

Industry Producing $7,000,000 Worth of Tackle Each Year Equips Sportsmen with Rods and Baits to Trap Finny Game

IMITATING bright-colored bugs, silvery minnows and other favorite prey of game fish is the task of an industry which annually supplies about $7,000,000 worth of tackle to enthusiastic followers of Izaak Walton who angle the lakes and streams of this country for sport.

Few factories make complete assortments of these products. While some specialize in rods and reels alone, others manufacture artificial flies, grasshoppers, gaudily decked hooks, baits and similar lures. One concern makes more than a million flies a year, and a rod manufacturer turns out about 50,000 such articles in the same time, in addition to nearly 500,000 wooden minnows.

Rods are constructed of bamboo or steel and as a rule consist of several sections or joints so they can be taken apart and carried easily. For the manufacture of the elastic wood varieties, the bamboo is imported from the Orient and each stem is split into many pieces, which are shaped into tapered triangular sections. Six of these are glued firmly together to form what is known as a split-bamboo rod. After cementing, the shafts are seasoned for several years when they are inspected and tested for strength. The ones selected for finishing are then scraped and sanded until the surfaces become smooth as glass.

In the mounting room, cork grips are fitted to the butts and reel seats are put on. A protective metal ferrule is forced over the thin end and the guides are wound on with silk, an operation so delicate that the entire process must be done by hand. Girl workers with long experience at such tasks are charged with the winding, which requires close application to avoid uneven coils. Several coats of elastic waterproof varnish are applied to the rods before they are permitted to be equipped with reels. All coats are applied with camel's-hair brushes and each one is allowed to dry thoroughly before the succeeding application is put on.

Reels are made with accurate machinery built for precision work, and the best of care is exercised in assembling the products. In some factories, each reel is con-

Lured by a Wooden Minnow, a Prize Catch Being Taken In by an Angler; and Test Tank Where Artificial Baits Are Tried Out for Action in Water

structed as a separate article and all pieces are manufactured as for an individual machine. Although this method is sometimes costly, it generally insures a smooth-running reel which will not readily give trouble to the user. Values of these tiny pieces of mechanism are frequently so high that the stocks are kept in fire and burglarproof vaults.

The manufacture of feather lures is almost entirely done by hand. Many varieties of feathers dyed in various colors are used. Those most commonly found in the factories are from the necks of chickens, known as chicken hackle, although feathers of geese, ducks, peacocks, ostriches and wild fowl are required in great quantities. On lures for trout, bass, and muskies, deer tails are often employed, and it is estimated that more than 10,000 of these are annually bought from hunters and fur dealers who gather them. About 35,000 of such lures are produced by one factory each year, calling for more than 150 different shades of feathers and like materials. At the same factory, a yearly supply of three carloads of white cedar is consumed in the production of wooden minnows for the floating and diving types of baits. For the heavier, sinking varieties, red gum from the gumwood swamps of the Gulf states is employed. The lumber is first cut into small blocks, about two inches square and five inches long, and turned in lathes to a rough shape of the tiny fish. They are then carved to the proper outlines, weighted with lead when desired, and enameled in the required finish. After being bored for hooks, screws and eyes, painters apply natural colors with air brushes, the fumes of the sprayed paint being carried off by blowers to protect the workers.

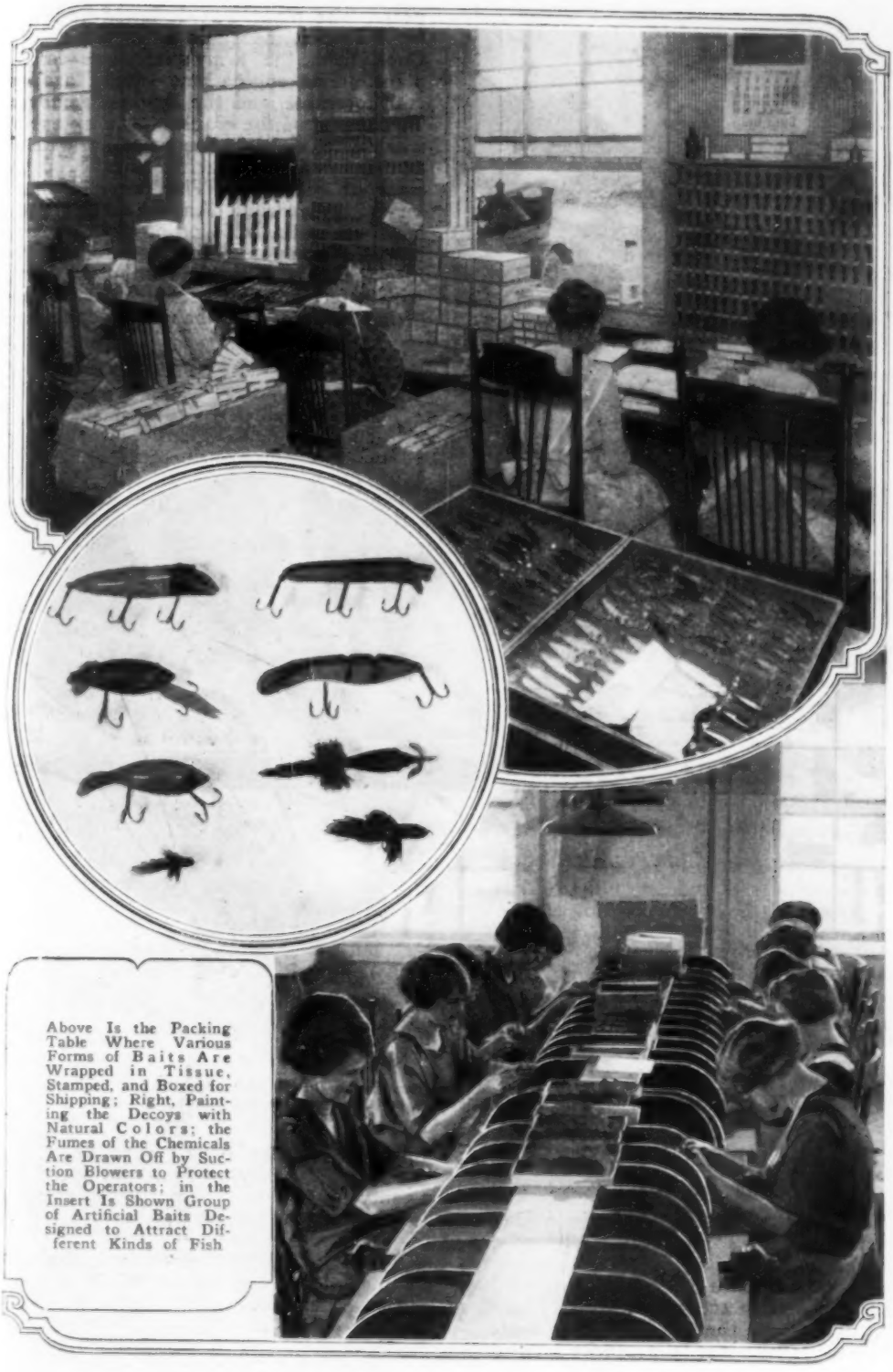
Some of the baits have a fish-scale effect, which is put on by spraying the colors through a fine netting. Glass eyes are made similar to tacks and must be carefully matched by the operator who hammers them in with a wooden mallet. No detail is overlooked to make the imitations as near like the originals as possible, since defective baits are rarely successful in performing their purposes.

To fasten the hooks and other materials on the wooden bodies of the lures, small power-driven screwdrivers are used. The holes are all bored before the articles reach the machines. For a wooden minnow at least sixty operations are necessary at the screwdrivers before the product is completely decked with its garb of feathers and hidden hooks. Inspectors finally pass on the quality of the baits, and send them to the shippers. Here each one is wrapped in a tissue-paper cover and packed for storage or shipment.

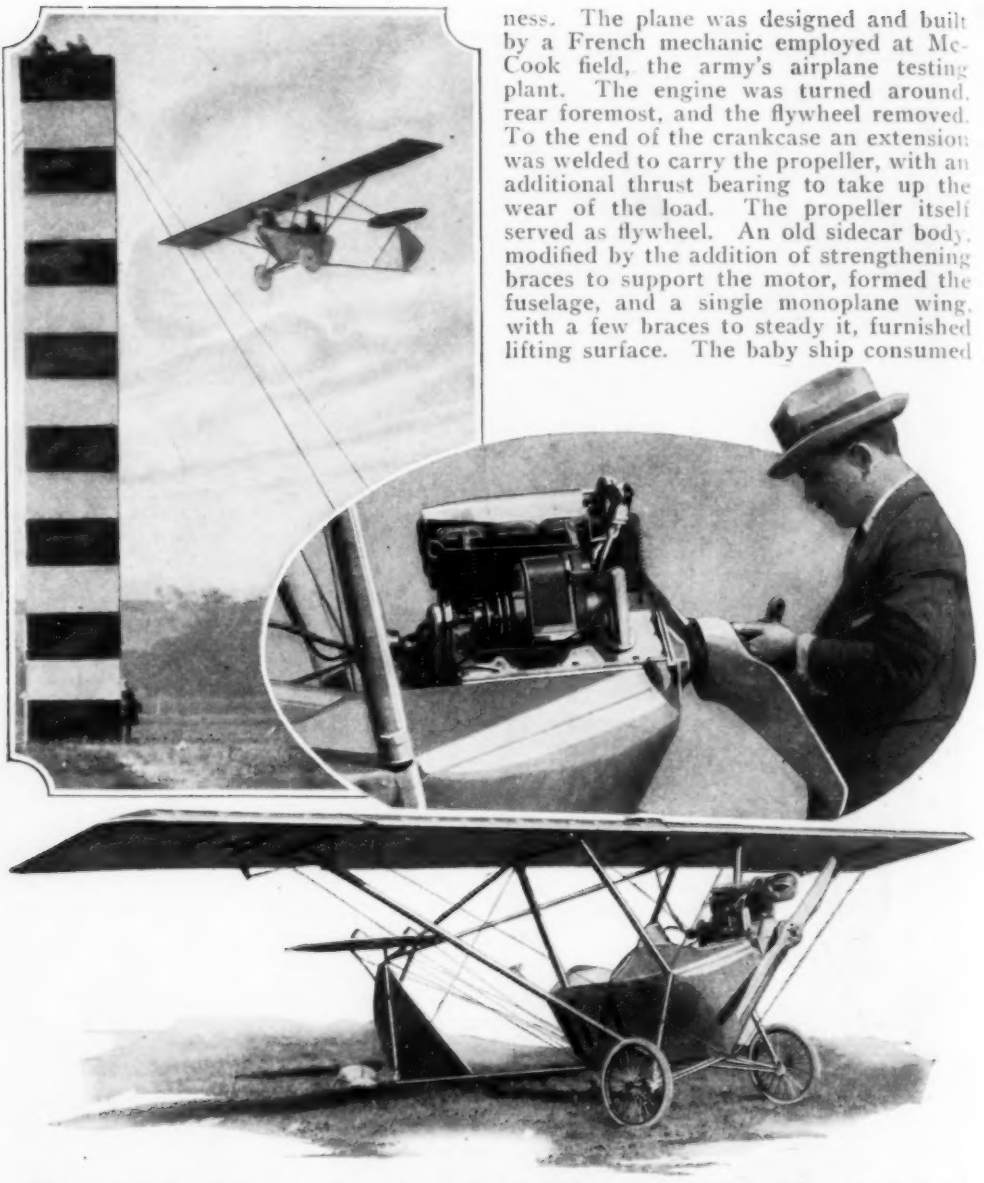
In the basement of a Michigan factory there is a forty-foot tank with testing and measuring devices for scientific bait development. It is used for trying out the various lures to determine their action in water. The baits are attached to a belt of cord passing over a wheel at each end of the tank. As the line is drawn rapidly through the water, the movements of the lures can be studied and any corrections necessary to make them more lifelike noted.

Courtesy of James Heddon's Sons

Winding Guides on Fishing Rods with Tough Silk Thread, an Operation Which Is Entirely Achieved by Hand to Assure a Smooth Finish



Above Is the Packing Table Where Various Forms of Baits Are Wrapped in Tissue, Stamped, and Boxed for Shipping; Right, Painting the Decoys with Natural Colors; the Fumes of the Chemicals Are Drawn Off by Suction Blowers to Protect the Operators; in the Insert Is Shown Group of Artificial Baits Designed to Attract Different Kinds of Fish



Sidecar and Motorcycle Engine as They Appeared Transformed into Speedy Monoplane That Flew Twenty-Five Miles on Half Gallon of Gasoline, and Start of 150-Mile Flight

"Flying Bathtub" Built Out of Junk Wins Air-Meet Race

A "flying bathtub," built in a Dayton cellar out of a secondhand motorcycle engine, the body of a sidecar and a few odds and ends of spare junk, flew a twenty-five-mile race at an average speed of fifty miles an hour, and then did a 150-mile cross-country flight just to prove its airworthiness. The plane was designed and built by a French mechanic employed at McCook field, the army's airplane testing plant. The engine was turned around, rear foremost, and the flywheel removed. To the end of the crankcase an extension was welded to carry the propeller, with an additional thrust bearing to take up the wear of the load. The propeller itself served as flywheel. An old sidecar body, modified by the addition of strengthening braces to support the motor, formed the fuselage, and a single monoplane wing, with a few braces to steady it, furnished lifting surface. The baby ship consumed only one-half gallon of gasoline, while maintaining a fifty-mile-an-hour speed for twenty-five miles. The performance set a new record for "flivver" planes.

¶By 1926, 20,000,000 motor vehicles will be in service in the United States, according to predictions of Thomas H. MacDonald, chief of the federal bureau of roads.

Radio Prospector with Loop Aerial Locates Hidden Ores

Locating hidden bodies of ore by radio signals has been accomplished both in the United States and Germany. The German device, called a "radio emanator," is being closely guarded by the Leipzig Mining company, but the American instrument, developed by Daniel G. Chilson, of the bureau of mines, University of Arizona, is being made available for all. The principle used is quite simple. The transmitting set is connected to the earth or, if possible, set up underground in a mining shaft to get it closer to the possible body of ore. The entire ore body then becomes a part of the transmitting antenna.

A receiver, mounted in a tripod, with a swinging loop aerial above, is used to detect the signals. The receiving set is of special design and employs several stages of amplification. In taking readings, the apparatus is set up with the loop in a vertical position, so the latter can be turned in an arc until the signals reach maximum intensity. This gives the "strike" or direction of the ore from the receiver. Without changing the strike, the loop is then "dipped" on its horizontal axis until maximum audibility is reached. This gives the dip angle. After the receiver has been set up in several locations and readings taken, the lines projected from the instrument give not only the location of the ore body, but its depth beneath the surface, which will be where the lines, prolonged, meet.

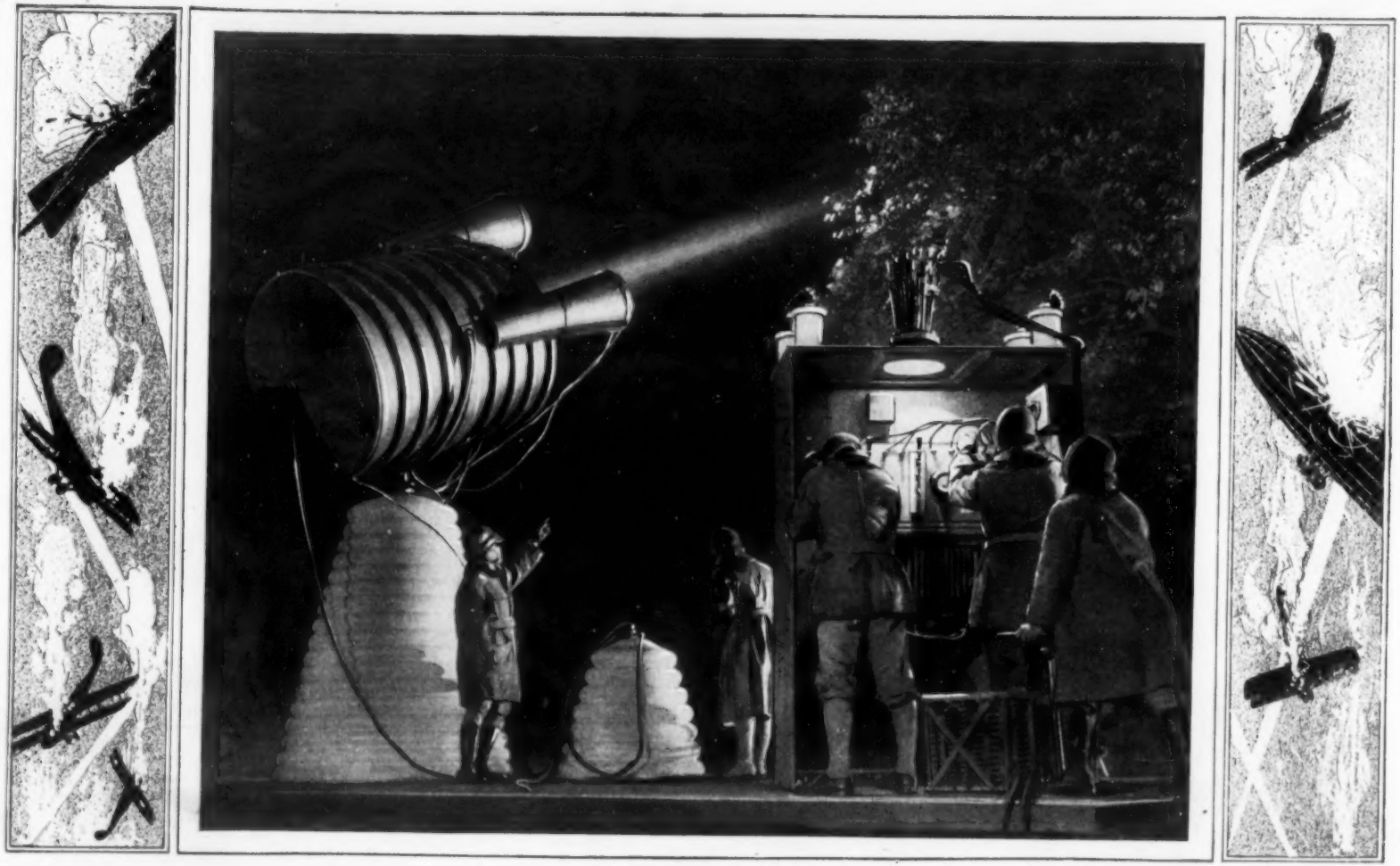
It is claimed that it is possible to cover thirty or forty square miles without moving the transmitter, while in ground rich in minerals, it is possible to move the receiver about and make as many as eighty or more set-ups and readings in a day. Experiments in the copper fields in Arizona have been highly successful. An operator who knew nothing about mining or geology took several readings in territory outside the mining district, and generally considered barren, getting indications of ore at several points. Some time later Mr. Chilson found traces of sulphides on the ground in four of the indicated places. The instrument now successfully developed by Mr. Chilson is the result of studies and experiments continued over a period of about twenty years.

Radio Prospector Seeking Ore with Tripod and Loop Aerial

Electric Coin Sorter Saves Time and Occupies Little Space

To save time and trouble in sorting and counting small coins, an electrically operated apparatus has been designed for economical installation in small space. It consists of a hopper, feed tray and four boxes, one each for pennies, dimes, nickels and quarters. A disk, revolved by a small motor supplied with current from a wall socket, carries the coins from the hopper and passes them to a sorting rail with openings of different sizes over the boxes. Dimes fall through first and the larger coins are carried on until they drop into their proper containers. The sorter is only two feet long.

Coins Passing down Slotted Trough and Falling into Proper Compartments from Hopper and Disk



Actual Photograph of Experimental Night Test with So-Called Death Rays, Powerful Electric Beams Which, Their Inventor Believes, Can Be Used to Destroy Airplanes and Other Machinery of War

Copyright, Pathe

Death-Ray Gunners in Rubber Suits Seek Safety from "Back Fire"

While scientists are not agreed as to the power of the so-called death ray recently invented, the men who operate the heavily charged mechanism take no chances on being injured by "back fire" from the tremendous current. They wear special rubber suits to insulate themselves from the apparatus. The base of the gun, a beehive-shaped affair which revolves, is composed of porcelain and rubber, while the coils in the three hornlike projections on the barrel are so arranged that the heat given off by them will not injure the rest of the machine. The completed assembly is twenty feet high, and its inventor claims that it will throw its rays 3,000 feet.

Pocket Billiards Played in Home with Pneumatic Cues

On a small table, weighing little more than twenty pounds, and with pneumatic and spring shooters instead of the regulation cues, the game of pocket billiards can be played in almost any room at home and with approximately the same demand on the skill that is required with the standard apparatus. The equipment is not a toy. The table frame is built of aluminum and contains gullies for the return of the balls as on regulation outfits. The top lifts off so that the table may be placed under a bed or set against the wall. Balls are made of the same material as the ordinary two-and-one-half-inch balls. The shooters eliminate practically all the trouble caused by handling cues in cramped space. The spring device is contained within a small box and is released by pressure on a button. There is a regulating attachment to increase or diminish the force of the stroke. With the pneumatic shooter, the ball is directed by a blow from a small plunger which darts out of the end of the rod when the rubber-bulb handle is pressed. Light strokes, follow and draw shots, and others are possible with these shooters, as well as with the usual cue, it is claimed. The table is cast in one piece so that it cannot warp.

Eighteen-Hundred-Bladed Penknife Folds in Separate Sections

To advertise its wares, an English cutlery company has constructed a striking display in the form of an enormous knife

Size of the Unfolded 1,800-Bladed Penknife Illustrated by Comparison with Man

with 1,851 blades. It is arranged in a series of sections that fold into one another. Each of the blades, none of them much larger than those found in an ordinary penknife, will open and shut, is highly polished and has a keen edge. A carved and inlaid back gives the knife a realistic appearance when it is closed. It is firmly fitted in a pedestal for exhibition purposes.

Augie Kieckhefer, Noted Three-Cushion Player, Shows His Family How to Play "Rotation" on Tiny Table with Pneumatic Cue

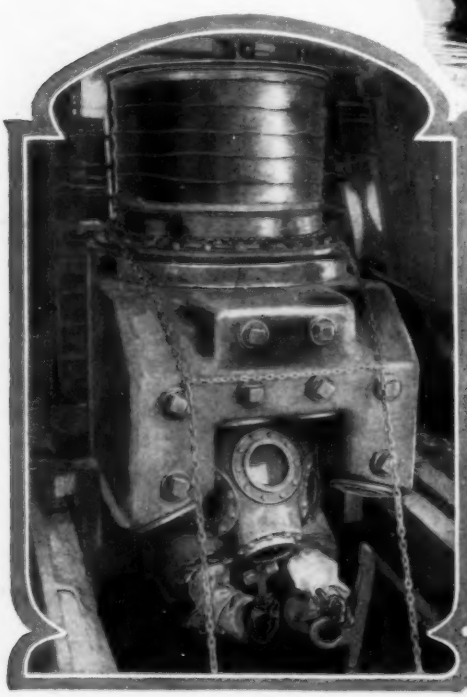
Electric-Lighted Diving Chamber Permits Work in Deep Water

For use in all sorts of under-water work, such as salvaging, sponge and pearl gathering and repairing ships, a southern engineer has constructed a diving chamber that permits considerable freedom of action and allows the worker to remain at his task longer than is possible with ordinary suits and rigging. The outfit consists principally of a massive electric-lighted extension compartment with openings for the arms, and portholes for illumination and vision. It is made of heavy metal to resist the tremendous pressure and may be lowered to various depths from a floating air chamber that remains on the surface. Connection is maintained by a tubular, hinged link section of special construction. The portholes are so arranged that rays from the lights shed their brilliance over a wide area, enabling the diver, who sticks his arms out of the holes, to use hammer, chisel and other tools with ease and accuracy. The entire equipment is managed from a barge tender which is fitted with air pumps, electric apparatus and various other implements necessary to submarine jobs. Recent tests with the outfit, which is said to be capable of operation at a depth of 800 feet as now constructed, are reported to have been entirely successful.

Spark Plug Grounds Static Current Reducing Crankshaft Vibration

Static electricity caused by the fuel mixture flowing into the cylinders at high speed, is said to be grounded by a newly invented spark plug. It has four points placed in such a way that the ignition current sparks the upper two only but magnetizes the forward ones so that they ground the static. This process is said to flash and increase the ignition flame, and to cause reduction in crankshaft vibration.

Barge Carrying Floating Chamber and Tackle at Stern; Diver inside Work Compartment at Bottom Showing Folding Collar, and Close View of Tank

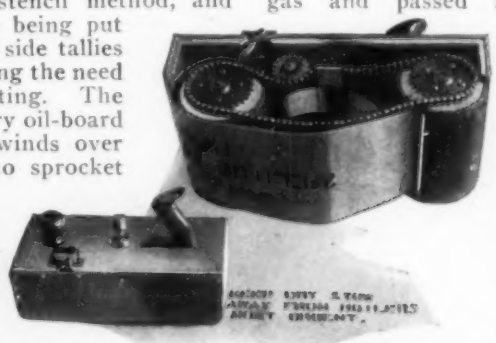


Ocean Bottom Rises and Falls in Waves, Charts Show

Islands in the seas which have been carried on shipping and marine charts for years are frequently found to disappear suddenly owing to unnoticed sinking of the ocean floors due to earthquakes and volcanic action. Many rise again from the same causes after ages of submersion. The largest isle of a group thrown up in the Pacific ocean by the earthquake which destroyed Tokyo, Japan, rose ninety-five feet above the water and gradually became covered with small vegetation. One morning it was found to have completely disappeared. Investigation showed that it sank back to a depth of twenty-five fathoms beneath the sea. In other volcanic regions many similar islands have appeared and disappeared during subterranean disturbances which pass otherwise unnoticed. Others reported to exist at certain localities centuries ago cannot now be found, though they are marked as "doubtful existence" and "doubtful position" on the maps which guide mariners. Some such isles thrown up in the past have remained to be settled by flourishing colonies, while hundreds of tiny peaks come and go with a regularity that gives great concern to the makers of the charts.

Stencil Marker Worked like Plane Saves Time and Labor

Closely resembling a carpenter's plane, a time and labor-saving marker for stenciling all kinds of shipping containers has been placed on the market. It is said to work eight times faster than the hand-operated brush-and-stencil method, and while the marks are being put on, a counter at the side tallies the articles, thus saving the need of a separate counting. The stencil, of the ordinary oil-board kind, winds and unwinds over two drums geared to sprocket wheels as the marker is pushed along. It is inked by a revolving brush which has a feed control regulated by the operator according to the kind of material being labeled. The handy tool weighs less than ten pounds, occupies but little space and effects a considerable economy especially in large warehouses.



Side View and Working Position of Marker and Sample of Its Lettering

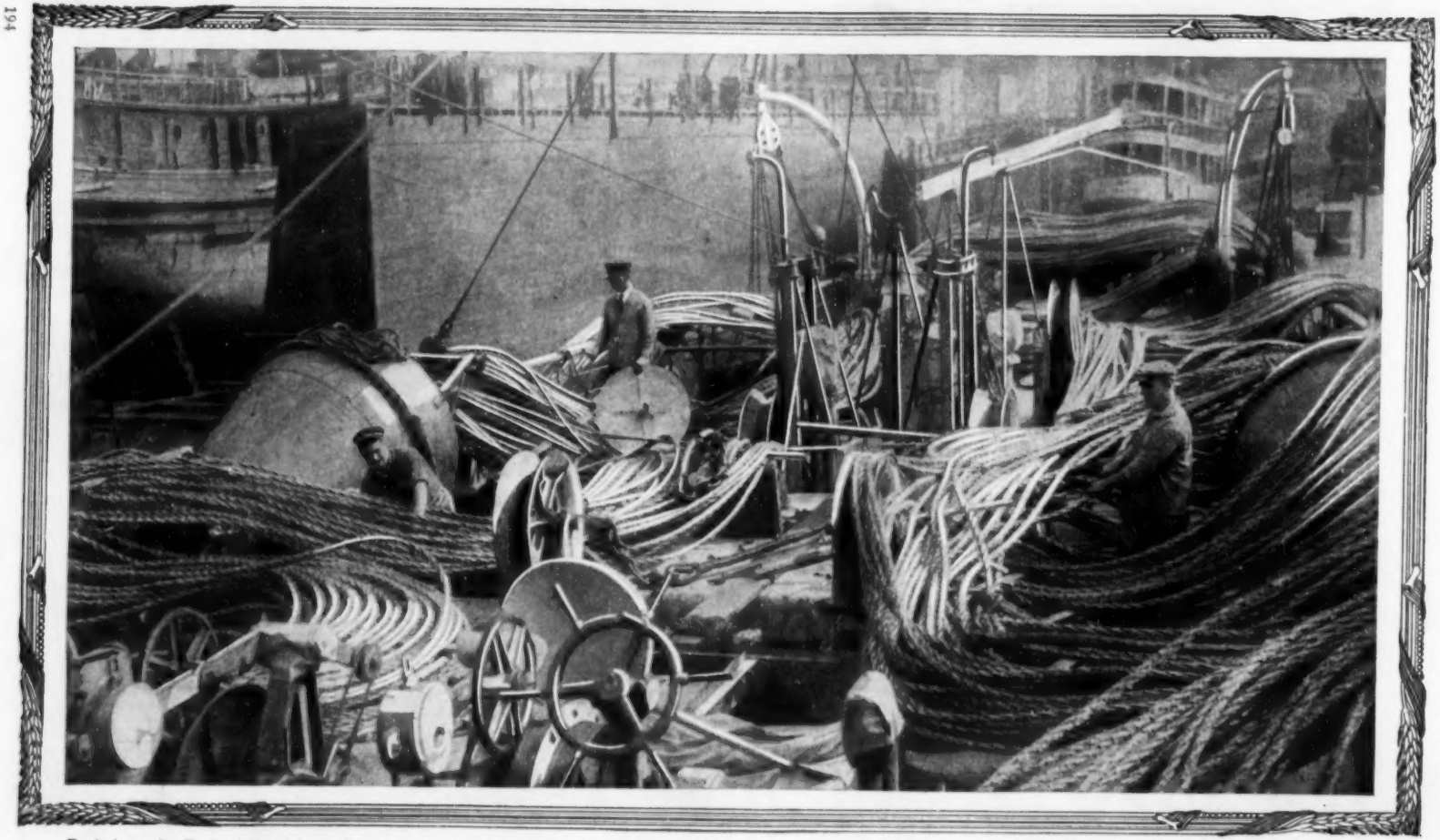
Portable Fireplace That Burns Oil Adds Comfort to Home

Comforts of an open fire without the bother of ashes and wood are provided in a portable kerosene heater that gives off

Fitted into Fireplace Niche, Portable Oil Burner Furnishes Ruddy and Comfortable Glow

an intense warmth from a clay back similar to that on natural-gas burners. It is so shaped that it fits within the regular fireplace or may be carried about even while burning and set in any desired position in the room. It is constructed as a unit, the fuel being contained in a pressure tank concealed in the base. The kerosene is forced through a small copper tube to the generator, where it is converted into gas and passed into an air-mixing chamber, and thence to the clay radiants. A gallon of kerosene is said to last from eight to ten hours and to yield sufficient heat to make up to 6,000 cubic feet of space comfortably warm.

¶By a vacuum-drying process developed in Sweden, lumber is said to be fitted for pattern and cabinet work within three days after the timber leaves the stump. The cost of the process is estimated at $1 per thousand board feet.



Back from the Task of Repairing a Break in the New York-Cuba Cable, the "All America," a Cable-Repair Ship, Docks at Brooklyn with Her Decks Littered with Miles of Undersea Wires, Gear, Marking Buoys and Other Paraphernalia

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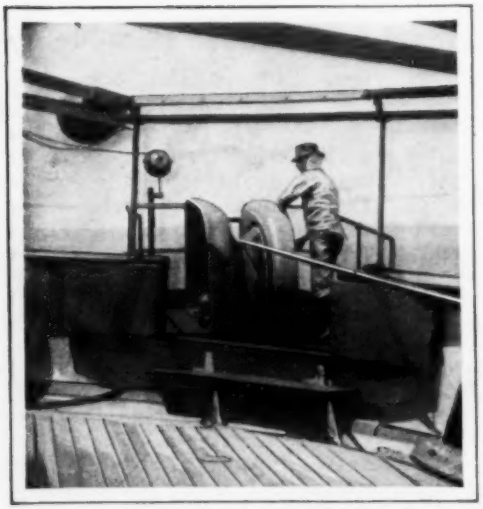
Around the World by Wire

Constant Cable Communication under the Seas Made Possible by Unceasing Work of More than Fifty Repair Ships

FAR out in the North Atlantic the lookout on a great liner's bridge in the lonely watches of the night occasionally sees two red lights, with a white one between hanging vertically from the foremast of a ship dead ahead in the ocean lane. The engine-room telegraph tinkles, and the twenty-knot mistress of the seas swings off her course to give the stranger a wide berth, for her lights are the international signal of a cable-repair ship at work, when she has right of way over all other shipping. The task of maintaining submarine cables, making possible telegraphic communication around the world, keeps more than fifty repair ships busy.

The cables are not much more than an inch and a quarter in thickness in the deeper portions of the seas, and breaks due to submarine earthquakes, chafing against rock or coral or to imperfect insulation are not unusual. When the break comes, delicate galvanometers at either end of the line locate it to within a space of a few hundred yards, and the repair ship is dispatched to the scene. She carries a complete electrical laboratory of sensitive instruments; huge deck tanks of from 150 to 200 miles of extra cable; big one-ton marking buoys, and grapnel hooks so ingeniously constructed that they perform two or three miles down in the ocean as well as human hands could do. When cables are laid, the ship keeps accurate observations as she crosses the ocean, showing the position of every mile, the depth of the water and the condition of the bottom. Electric recording logs chart the distance traveled, as the ship moves forward, paying out six to eight miles of cable an hour. Bottom "samplers," built like the clamshell buckets of steam shovels, show the nature of the sea floor, and delicate depth gauges record how far below the surface the cable is placed. With these data the repair ship is able to proceed direct to the location of a break. Here a marking buoy is anchored. The vessel then steams off a mile or so to one side, turns back, drops a grapnel over the side, and moves slowly across the course of the cable, repeating the operation until the cable has been hooked. The grapnels themselves are remarkable devices. Because of the enormous depths at sea — the San Francisco-Shanghai cable is five miles below the surface at one point, while off the Azores an Atlantic cable is three miles down — extreme care must be taken to keep the cable from breaking under the strain. One grapnel is built so that it simultaneously cuts the cable and grips the severed ends. Another type rings a bell when the cable has been hooked or

Steaming Forward along the Cable Line, with Lookout Watching for Faults as Wire Passes over Grapnel



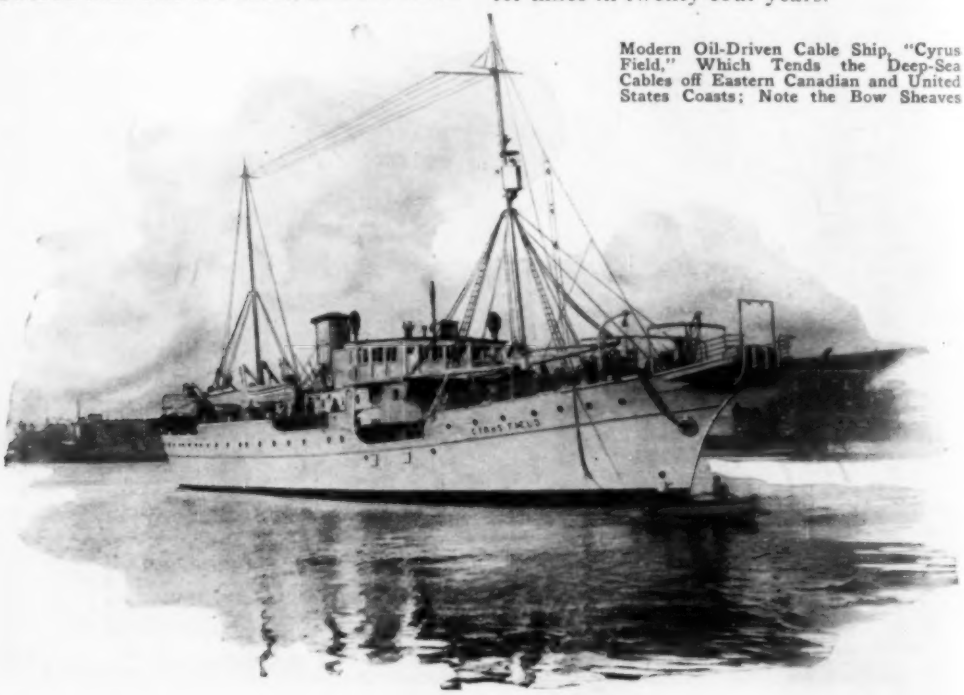
Lifting the Cable, with the Wire Passing through the Bow Sheaves on the Foredeck

when the grapnel enters water so deep that more rope must be payed out.

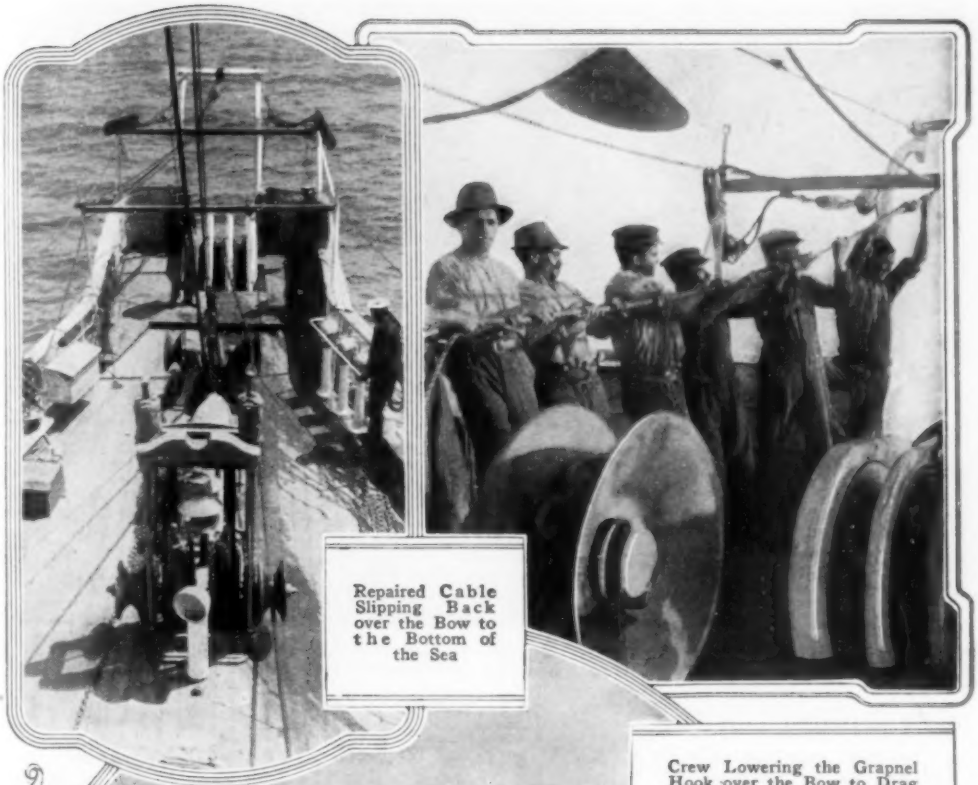
To take care of the strain of lifting, considerable slack is payed out as the cable is laid. Sometimes, however, the strain on the grapnel rope will become so great as to involve risk of breakage. Then the rope is fastened to a buoy, the ship steams away some distance, another grapnel is lowered that cuts the cable, and the loose end is hauled aboard, while the other is picked up from the buoy. As soon as the end is aboard, the sheathing of cotton, brass tape and rubber is stripped from the copper core, and the wire connected up to the laboratory apparatus. Tests are started to locate the direction of the break, and the vessel then steams toward it, allowing the cable to run through sheaves while a lookout keeps watch from a boatswain's chair for defects.

Through the cable, but ashore, a constant watch is being kept for the ship's signals. A lamp reflected by the mirror and lens of the sensitive galvanometer records the signals as the beam of light moves back and forth. Once the break is located, it is either repaired or the bad section is cut out and a new piece spliced in from the ship's cable tanks. The vessel then steams back to the buoy marking the other end, if it has been necessary to cut the cable, and the final link is made.

The depth and condition of the bottom are important considerations when a cable is laid, as enough slack must be payed out to pass over the undersea mountains and down the ocean valleys. One of the worst causes of breaks is the frequent seismic disturbances under the sea. In 1923, it was discovered that the bottom of the Atlantic near St. Helena, on the Capetown cable route, had risen two and three quarter miles in twenty-four years.



Modern Oil-Driven Cable Ship, "Cyrus Field," Which Tends the Deep-Sea Cables off Eastern Canadian and United States Coasts; Note the Bow Sheaves



Repaired Cable Slipping Back over the Bow to the Bottom of the Sea

Crew Lowering the Grapnel Hook over the Bow to Drag for the Submarine Cable, Which Must Be Lifted and Tested Until the Defective Spot Is Located

Testing New $4,000,000 High-Speed Cable from New York to Italy, with 1,700 - Letters-a-Minute Capacity

Stepping into Radiant Area of a Powerful and Carefully Focused Floodlight, Shining from Above, Passengers Are Plainly Visible to Motorists Approaching the Safety Zone

Paint Mixer with Adjustable Paddle Works through Hole in Can

Much of the time and labor required to prepare batches of paint with a stick is said to be saved with a mixer that may be slipped through a hole in the top of the can. It has paddles of metal which normally are in a perpendicular position to allow insertion or withdrawal, but in the can fall into a horizontal plane and are rotated by a crank like that of a carpenter's brace. Paint can be thoroughly mixed in fifteen minutes with this tool, it is said. The contents are kept from dirt and dust and the aperture, easily plugged, may be used for pouring the paint into a smaller container.

¶Although earthworms have no eyes, they are said to be able to "feel" light through their skin.

"Light Platforms" for Safety Zones to Reduce Accidents at Night

Studies recently made in thirty-two cities show that seventeen per cent of the fatal traffic accidents that occur at night may be traced directly to insufficient light. To reduce this number and afford better protection for the pedestrian and the street-car and auto driver as well, a plan has been devised for illuminating street safety zones by putting flood lamps high above the street at car stops where the rays will light the area used by passengers getting on and off. The beam covers a zone four feet wide and seventy-five feet long. The lamp is mounted at a height of twenty-three feet and twenty feet back from the zone limit.

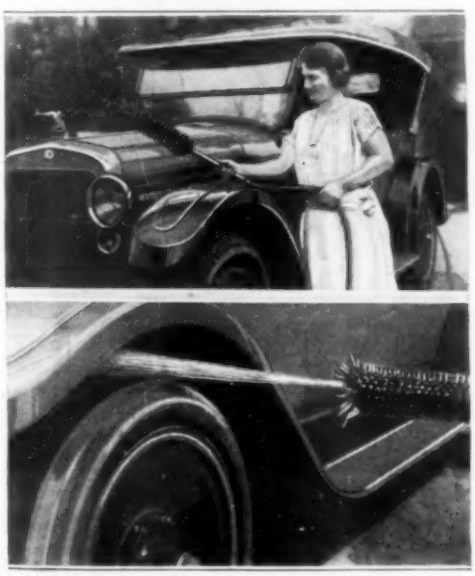
Coal Analysis Catches Thieves

Analysis of the coal that thieves had used to replace a consignment of gloves they stole in Germany from a shipment of merchandise on its way to San Francisco, aided in identifying the criminals after receipt of the crates at their destination. Lumps of the fuel were found carefully wrapped in the packing straw to weight the boxes and avoid discovery of the theft during transport. In an effort to locate the mine from which the mineral was

taken, the coal was analyzed and checked by experts in the employ of the freight agents. It was learned the source of the material was a well-known working near a small town in the Ruhr district. The information was communicated to the German police who traced the deed to a gang of thieves operating in the mining center, and recovered the stolen gloves with the arrest of the band.

Auto-Cleaning Brush Fitted on Hose Saves Work in Washing Cars

For washing automobiles quickly and thoroughly, a brush that is designed to reach into corners and difficult places has been invented. It is attached to the end of the garden hose and has a three-way valve so arranged that water can be directed from either side, or from the end in a straight, steady stream for rinsing. With the side streams running through the bristles, the exposed parts of the car can be quickly cleansed, while the strong stream that shoots from the end, strikes under the lower parts and into crevices and corners with sufficient force to remove dust, dirt and oil, it is claimed. The brush prevents splashing and wetting the clothing as often occurs when buckets and sponges are used; the bristles are soft and fine so that they will not scratch the finish, and the cleaner is durable, fits any garden hose and does away with much handwork and tiresome stooping over.



Using Brush to Clean the Hood, and as Hose to Reach Under Parts of Car

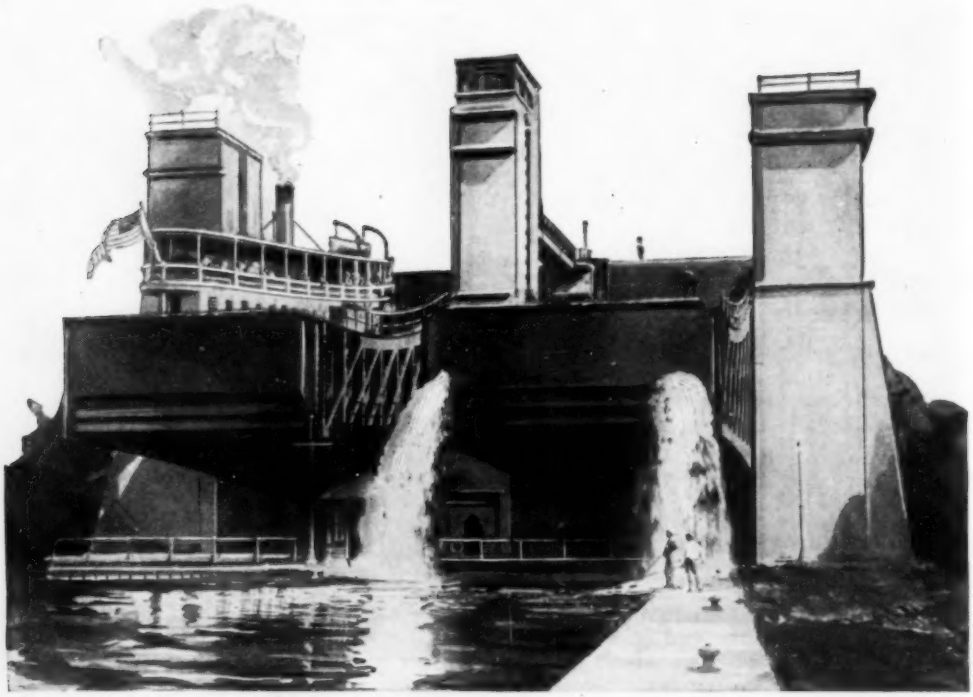
Finishing Steel Work on the Skyscraper Cross That Will "Preach" to Thousands Day and Night

Electric-Lighted Skyscraper Cross to Blaze Message for Miles

As a silent preacher, a huge cross, fashioned with steel beams after the manner of a skyscraper, has been erected on the heights of historic Mount Royal at Quebec. Electric lights will make the emblem visible at night, and because of its huge size and location on the lofty summit, the cross can be seen from a considerable distance even by day.

Wrapping Twine from Pine Trees

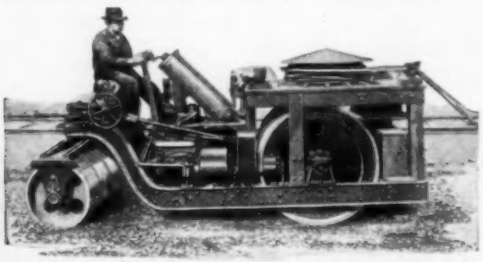
String that is said to be as strong as that made from hemp is being manufactured from the pulp of pine trees by a southern paper company. The long fibers of the wood, three times the length of those of the spruce, are well adapted for making into cordage and the product is reported to be especially fitted for wrapping twine.



Lowering a Canal Boat in the Hydraulic Elevator Locks, the Ascending Pontoon Being Lightened by Release of Water from the Tank as It Nears the Upper Level

Electrified Road Roller Operated with Power from Trolley Wire

When a steam roller owned by a western company required an extensive overhauling, engineers decided the boiler was past repair, but put the rest of the outfit into service by installing a railway-type electric motor for driving power. Current connection was made with the trolley wire of an interurban line at the side of the road by a cable on an automatic winding reel in front. The roller, thus remodeled, gave satisfactory service, it is said, and



Supplied with Power from Near-By Trolley, Electrified Road Roller as It Appeared Remodeled

as only one man was required for operating, it saved hiring a fireman.

Locks That Work like Elevators Lift Canal Boats Sixty-Five Feet

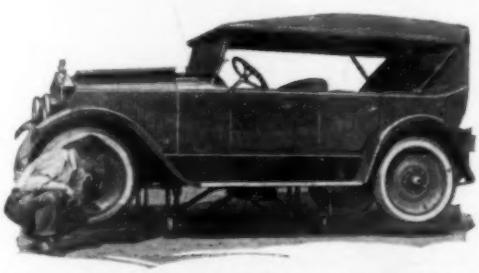
How application of the principles of mechanics has assisted navigation is well illustrated in the huge hydraulic locks in the Trent Valley canal at Peterborough, Ontario, where boats ride in elevators up and down a sixty-five foot lift, said to be the highest in the world. So nicely is the entire mechanism adjusted, a ship can climb or descend the "hill" and get on its way again in from six and one-half to eight minutes, and only three men are needed for the operation, a lockmaster at his controls in his cabin in a 100-foot central tower and two assistants to manage the gates. In principle, the works are similar to two huge hydraulic elevators of the simple plunger type, the locks being so connected that the descent of one causes the rise of the other. In place of the ordinary elevator platform or car, there is a large tank closed at each end by gates, which are made water-tight by inflating rubber tubes around them with a pressure of ten pounds to the square inch. The lock chambers are 140 feet long, thirty-three feet wide, carry 500 tons of water upward and 600 to 650 tons down.

Wheat Grows Twelve Rows to Head and Stems of Solid Straw

Wheat grown under ordinary conditions on the experimental farm of Dr. Seager Wheeler in Saskatchewan, Can., bears heads of grain containing twelve rows of kernels. Other strains of plants are said to ripen within thirty days after the shoots appear above ground, and grades with both hollow and solid stems of yellow and purple have been reared without any special efforts of cultivation. Wheat berries as large as navy beans are also reported to have been developed on the tract, and specimens have been raised on which the heads ripen while the stalks are still green. It is believed that of sixty-five sturdy and fruitful species under cultivation, many will be found to resist plant diseases as well as stand up against heavy storms common to that region.

Rolling Jacks Worked from Auto Move It Sideways for Parking

Operated by a lever from the inside of the car, a wheeled hoist attachment for automobiles raises the machine so it can be rolled sideways into a narrow parking space. After the vehicle is lifted from the ground, small wheels of the elevating apparatus allow it to be pushed to either side with little effort. When the car is needed, it may be shoved out into clear



Automobile Raised by Rolling Hoist Attachment Which Allows Car to Be Moved Sideways

space and the jacks released and drawn up close to the running gear to avoid protruding obstacles in the road. Used in congested streets of large cities, it is claimed the device will prove a timesaver and result in the parking of large numbers of automobiles in limited spaces along the curbs.

¶Bricks are used as scrubbing brushes in India in giving elephants baths.

Model Glider Stays Up Ten Minutes Flying Mile and a Half

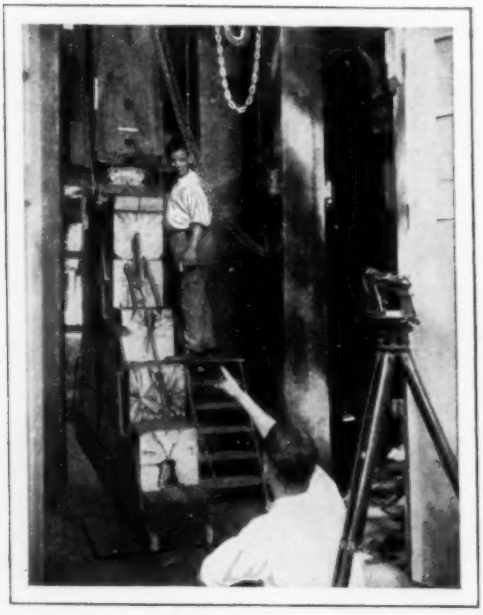
While real airplanes were demonstrating the latest achievements in aerial navigation at the races at Dayton, Ohio, a

Miniature Biplane Glider That Flew a Mile and a Half, and Its Young Designer

model glider, made by Robert V. Jaros of the University of Chicago, skimmed over the field and shattered all previous records for flights of miniature planes of this type. The tiny ship remained aloft for ten minutes and fourteen seconds and traveled a mile and a half before it finally fluttered to the ground.

Houses of Metal Built in Day

Modern four-room dwellings, built of non-burning materials covered with a thin veneer of metal, are being erected completely in twenty-four hours by builders of Budapest, Hungary. Although the homes are inexpensive, it is claimed they have the advantage of being protected against fire and will last over a long period of time without the need of repair. The parts of the structures are all designed and prepared before construction is started, so that the pieces may be quickly slipped into place and fastened without further fitting or cutting. The method is reported to have been copied from that employed in the manufacture of toy houses made from sheet metal.



As Big Blocks Were Squeezed in Powerful Press, Cracks Were Measured with Surveyor's Instrument

Drydock Blocks Tested in Press to Assure Safety for Ships

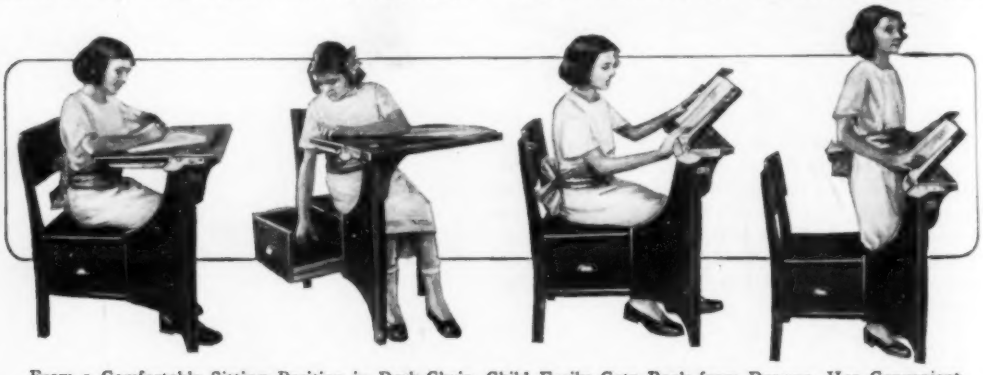
To determine the exact load that each wooden keel block, the supporting units placed under the vessel in a drydock to protect and hold the hull, will stand, the forest products laboratory recently tested five of them in a gigantic press. The timbers, each fourteen by fourteen inches and of clear white oak, had been submerged for a week in a lake so that they might be tried under the same moisture conditions as would be found in actual service. The load was transmitted to the top of the blocks by a roller bearing in such a way as to allow them to keel over sideways as they would in failing beneath a ship. As pressure was applied, record was kept of the force exerted, and the pieces were studied for cracks, fissures and other signs of failure.

Sunken Treasure Liner Is Found by "Sweeping" Ocean Floor

Dragging the floor of the ocean with an iron "sweep" a mile long, two trawlers working near the coast of Virginia found the wreck of the treasure-laden steamer "Merida," sunk in 1911. The vessel, which went down after a collision, was carrying a cargo of gold, silver, copper and precious stones now valued at a sum between $2,000,000 and $5,000,000. The search was instituted by a group of wealthy men who financed the undertaking after having the records of the accident carefully checked over with surveys made of the vicinity.

Combination Pupil's Desk and Chair Saves Schoolroom Space

As a solution of the overcrowding problem, now a matter of considerable importance in many schools, a western firm has placed on the market a compact combination pupil's chair and desk. It can be moved about the room and utilizes some of the space usually left for aisles. Its chief feature is that the child has ample room to stand and recite, without stepping to the side of the seat, simply by raising the folding top of the desk. On dark days, pupils may be placed quickly where there is the most light by moving the desks, and groups for special study may be arranged in the same way. Below the seat is a drawer for books and papers. The desk is durably constructed and so shaped as to afford a comfortable and correct position.

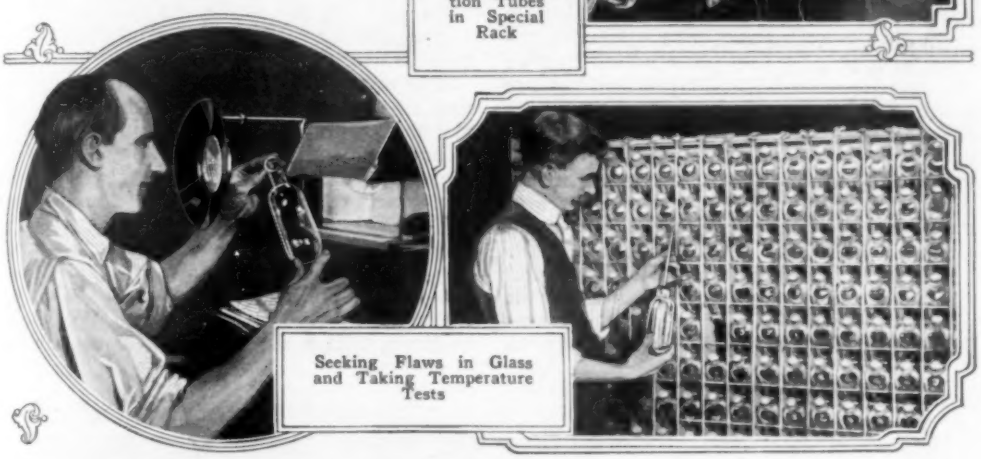


From a Comfortable Sitting Position in Desk-Chair, Child Easily Gets Book from Drawer, Has Convenient Reading Rack and Ample Space to Stand without Stepping into Aisle

Electric Spark in Vacuum Bottle Tests Removal of Air

In making vacuum bottles, the greatest skill is required to handle the glass parts, which consist principally of two rounded bottles, one within the other, inclosed in an outside metal jacket. The inner bottle is slipped within the larger one which, at first, has no bottom, and the two are fused together by melting them at the neck. Then the larger end of the outside bottle is drawn to a tube-shaped point, and a hole is made in it through which is poured a silver solution that coats the inside of the outer bottle and the outside of the inner one, to prevent radiation when the container is put into service. The air between the bottles is extracted by means of rubber tubes connected to a pump. To determine when sufficient air has been withdrawn, tests are made by shooting an electric charge through the space between the walls. This produces a colored glow within the space, which becomes fainter as the evacuation proceeds, and when it is almost invisible, the end of the tube is sealed by the melting process. The bottles are then inspected and tested. Boiling water is poured into them and left for twenty-four hours. If it cools more than ten degrees, the bottle is condemned.

Pumping Air from Bottles with Suction Tubes in Special Rack



Seeking Flaws in Glass and Taking Temperature Tests

Cost of Stopping Trains and Cars Amounts to Millions Yearly

Everyone knows that it costs huge sums to keep the world's machinery in motion but the layman seldom thinks of the millions of dollars expended just to stop the wheels when occasions demand. For instance, every time a train of a dozen cars or so grinds to a halt at a station, it costs the railroad company about $4. Wear on the brakes, wheels, rails and the locomotive, all must be included. A large elevated-railroad company has estimated it costs about two cents a car to stop and start the trains. Surface lines' engineers say the expense for the same operations on street cars is slightly higher. Under average conditions, it costs a small fraction of a cent to stop an automobile, but a taxicab company, operating about 3,000 cars, estimates that it spends several thousand dollars a year just to make halts for passengers and at traffic stops. The roller coasters at the amusement parks usually require one or more brakemen to slow the cars down from their giddy whirls, and friction brakes must be renewed frequently and kept in constant repair.

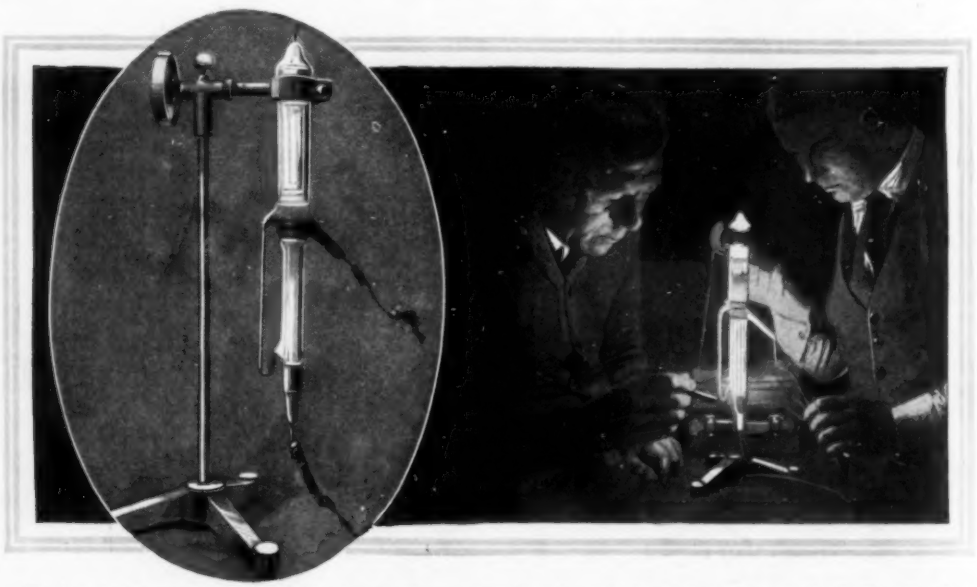
Mercury-Arc Lamp to Protect Eyes

Harmless to Vision and Free from Flickers, Soft, Bright Glow Takes Place of Sunlight for Camera

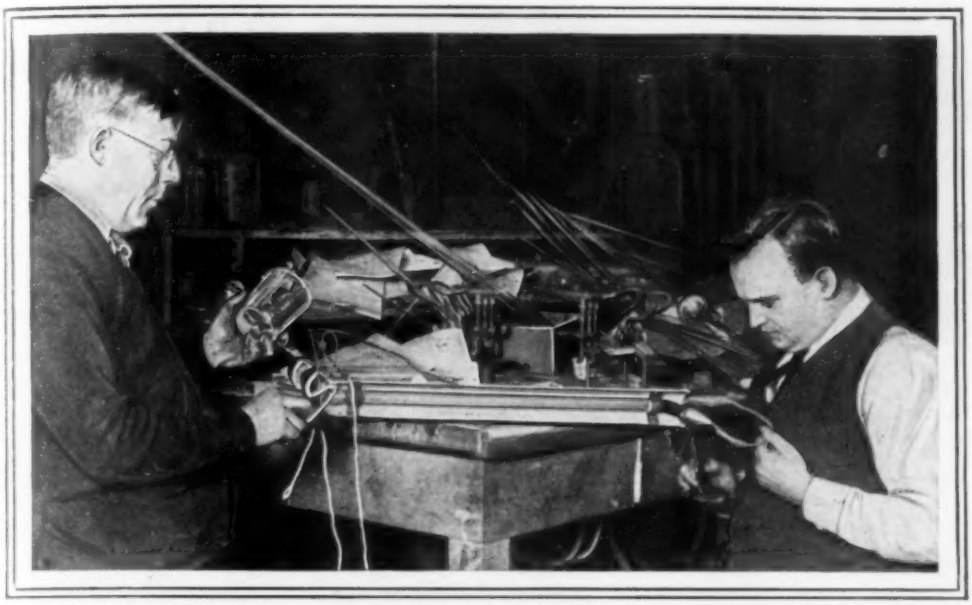
EMPLOYING an electric current far stronger than any heretofore used in an equal amount of space, a mercury-arc lamp perfected by mechanics of the chemistry school of the University of Chicago, restrains the escape of rays injurious to the eyes of those engaged under its glare. The lights are designed to furnish illumination for photographic work, delicate laboratory tasks and for all purposes where a substitute or aid for daylight is required. The light, which is said to produce about five times the brilliancy of other lamps of similar type, prevents flicker by means of a siphon arrangement that carries the condensed mercury back to the bottom of the bulb without passing it through the vapor arc. This feature results in a steady, soft glow which can be increased or diminished by adjusting the amount of current permitted to pass through the arc. The tubes are of special heat-resisting glass, which does not pass the ultraviolet rays, so often found to result in painful injury to the eyes, and might replace the glare of "Klieg" lights against which movie workers must often be masked. For this reason it is believed the lamp might materially reduce the ill effects produced on the vision of motion-picture actors and others called upon to spend a great part of their time under the dazzling glare of the strong lights seen in the majority of photographic studios.

Before the mercury is placed in the glass bulbs, it is subjected to a thorough cleaning in specially constructed apparatus which extracts almost every trace of foreign matter from the mineral. In this way, not only is the quality of light improved but the greatest amount of service is gained, as the process leaves nothing that can impair the steady burning of the arc. The tubes also are carefully cleaned of all particles of dust or other material that might collect on the smooth surfaces, and baked in a vacuum under intense heat. This process is to prevent the entrance of any dirt into the liquid metal during its flow through the tubes.

The mercury tubes can be made in almost any size and shape to meet the needs of the users. On each a condensing chamber is provided into which the vaporized mercury can pass as it rises from the bottom of the arc, returning by way of the siphon tube to the boiling level, thus avoiding contact with the arc and eliminating annoying and undesirable interruptions or breaks in the flame. So readily is the electric circuit formed when starting the lamp to burn, that a slight turn of the tube is



Testing the Return Speed of the Condensed Mercury Passing through the Siphon Tube to the Boiling Level; Insert, Close-Up of a Desk-Type Lamp and Bracket



Designers of the Siphon Mercury Arc Lamp, Charles Hanson and George Reppert, Filling the Condenser and Attaching the Electrodes of an Overhead Tube Light in Their Workshop

sufficient to complete the circuit in the bulb, and but slight resistance is required to control the brilliancy of the glow.

In order to insure the highest vacuum obtainable in the bulbs, they are pumped out by specially built mercury condensation pumps to insure a light free from injurious gases that may retard the production of a clear, strong glow. And despite any increase of the size and strength of the lamps, the surface of the glass keeps comparatively cool, making it possible for workers and others to remain within close range of the glare without need of protection against burns or excessive warmth. Since more light can be generated in a small bulb than is ordinarily possible with other lamps, the mercury arc equipped with the siphon may be set up in large batteries or groups, either for overhead suspension or for arrangement along the walls of studios and similar inclosures where great volumes of illumination might be needed. It has also been pointed out that the light may be constructed in a portable case for use by photographers instead of flash powder for night exposures, and sizes to correspond with the familiar incandescent bulb may be made for desk and table use or as part of decorative clusters in signs and show-window displays.

The glass employed as containers for the lights is of such a nature that it can be readily worked into almost any shape. Among the various types of lamps that can be formed from this material are those fashioned in long spirals, squares, triangles, and circles for special service in the illumination of studios and laboratories, and in straight barlike tubes which can be set upright or suspended horizontally from overhead brackets where only the ordinary lighting effects are desired, such as illumination of shops and workbenches.

Scientists to Search Sea Jungles in Hunt for Giant Squid

Turning to the sea for one of the most extensive big-game hunts ever organized, a party of scientists from the New York Zoological society seeks to plumb the depths of the Sargasso Sea and other mysterious caverns of the ocean for trace of the giant squid and kindred creatures little known to man. The expedition, headed by Dr. William Beebe, has fitted the 280-foot steamer "Arcturus" with elaborate equipment for scientific research, including hooks, dredges, traps, diving apparatus, complete photographic layouts and a radio-broadcasting set, and contemplates a six months' tour. The ship has a cruising radius of 13,000 miles. Short inland trips in remote sections will also be made and collections of bird and animal life will be gathered on shore as well as from the deeps of the sea.

Pushing and Pulling with Feet and Arms, Youngsters Both Turn and Teeter on This Little Merry-Go-Round

Merry-Go-Round and Teeter in One Give Healthful Exercise

Both for indoor and outdoor play, a combination merry-go-round, teeter and rowing machine has been devised for small children. It is designed with two or four seats that rest in a framework propelled in circles by alternately pushing with the feet and pulling with the hands. With each revolution, the child rises and falls six inches with a smooth, easy motion. The entire device occupies about five square feet, is easily portable and besides furnishing fun, is said to be a splendid exerciser for young arms, backs and legs. There are no chains, gears or belts to get out of order or cause injuries.

Aerial Traffic Claims Only Six Lives in Five Years' Operation

Despite the wide range of operation and large volume of passenger traffic, only six lives were lost in commercial aviation in England during the past five years, according to reports. In that time more than 50,000 persons were carried and the combined flights totaled about 4,000,000 miles. In 1919, only twenty passengers were transported by the entire English commercial air service. Now regular schedules are in force between London and Paris and planes make six trips a day over that route. Daily passenger flights are also made to Berlin, Moscow and Cologne and freight capacity of the craft is booked completely several days in advance. New routes are being opened up to include Zurich, Rome and Madrid in the air lines. So great has been the increase in the business of aerial transportation in Britain, that rates of fare have been reduced from ten cents to seven cents a mile.

Efficiency of Brakes Shown by Tester

Accurate measurements of the efficiency of automobile brakes are taken by an ingenious instrument used by the United States bureau of standards. It tells within how many feet from the point where the brakes were applied any car, regardless of its weight, can be brought to a stop from a speed of twenty miles an hour. The device, outwardly resembling a small bucket with a square-shaped bail and a dial for a lid, is simply placed on the floor of the car. When the brakes go on and speed slackens, a weight suspended on springs inside the instrument is thrown forward, moving the pointer to a figure on the dial corresponding to the number of feet the car will travel before it stops.

Copyright, Harris & Ewing

Auto-Brake Tester with Dial Top in Working Position on Floor of Car

Miners Using the Gas Detector on Roof of Gallery, and Close View of Apparatus Showing the Bulb and Tubes

Color Change Reveals Poison Gas to Save Lives in Mines

One of the most dangerous of all poison gases, carbon monoxide, is quickly revealed by color changes in a chemical solution now being used in rescue work following mine fires and explosions. The apparatus consists of a tube of charcoal through which the air to be tested is drawn by means of a rubber hand bulb. It is then discharged through another small glass tube containing the chemical. The charcoal removes any gas other than the carbon monoxide, and interfering dust and mist are stopped by cotton-wool filters. If the gas is present, the chemical turns from white to violet-brown and finally black, depending on the amount of poison in the atmosphere. No special skill is required in the operation of the detector.

Aside from its use in mines, the device is also of value for testing the air around blast furnaces, gas producers, city gas plants and may be employed to promote furnace economy by indicating the percentage of carbon monoxide in the gases escaping from the flues.

Food for a World Cruise

A large city could be supplied food for many days, with plenty for every person, from the larders of a modern ocean liner prepared for a round-the-world voyage. On a big vessel with a full passenger list more than forty-two tons of beef, twenty-one tons of mutton and four tons of veal of choice grades are consumed in addition to 50,000 oysters, sixty tons of potatoes, and over 51,000 chickens, ducks, turkeys and wild fowl. Requirements of milk, cream, ice cream and preserves run into enormous figures. Crates of canned vegetables are hoisted aboard in stacks as big as a large room, and the supply of bread and pastries is furnished by 500 barrels of flour and 2,600 tins of biscuits. Fresh eggs are used to the number of 180,000, and among smoked meats bacon ranks first with an item of 17,000 pounds.

Fingerprints Are Enlarged to Help in Identifying Criminals

Identification of criminals is said to be made easy by a camera which enlarges the prints of finger tips to reveal the slightest characteristic in the design of whorls and lines. Although the ordinary photographs made for police files are accurate copies of the telltale marks, reproductions made by the fingerprint machine may be used for rapid comparison, eliminating the need of powerful magnifying glasses. The large charts are also valuable in the instruction of detective forces charged with the tracing of criminals and in the study of identification methods.

Instructing Police Executives in Fingerprint Identification with Chart Made by Enlarging Camera Below

Electric Motors in Logging Camps Replace Horses and Steam

Electric motors are replacing horses and steam engines for logging and lumbering in many parts of the country, according to public utility reports. Every year, more current becomes available through the spread of transmission lines, electricity has been found faster than older methods, it is independent of the water supply, and the menace of fire is greatly reduced. Furthermore, the motors can be quickly moved from cutting to cutting. It is estimated that fifteen kilowatt-hours of current will handle 1,000 board feet of lumber from the stump to the loaded car, yanking it down the skidway and lifting it to the trains or waterways that carry it to the mills. There are now nearly 70,000 electric motors in the lumber industry, driving the great ripsaws and other milling machinery that convert the annual cut, valued at about $900,000,000, into finished products worth approximately $2,500,000,000. The lumbering industry last year required 800,000,000 kilowatt-hours of electrical energy.

Guns for Uncle Sam's Navy Made in Kitchens for Cooking Steel

Extracted from the ore by fuel, limestone and air in the blast furnace, the metal for the big naval guns at Uncle Sam's factory, in Washington, D. C., goes to a foundry which is like a big kitchen where the steel melter is the "cook." The raw materials have been analyzed by laboratory experts who send a "menu" to the melter by which he selects the correct amounts of pig iron and scrap steel. These are then subjected to a temperature of more than 3,000 degrees in a huge furnace until the cook thinks that all impurities have been removed and the mass is ready to tap. Before this is done, a long-handled spoon is filled with a sample of the metal, cooled and sent to the laboratory for analysis. A favorable report may be given or the white-hot contents may need seasoning with carbon, nickel or chromium. Afterward, the steel is forged, a step somewhat like the kneading of bread dough to give the metal the required strength by working it under temperatures of from 2,200 to 1,400 degrees. The forged parts are then machined and assembled.

Dog Mascot Decorated by Pershing Pays Visit to President

"Stubby," mascot of the 102nd Infantry of the Twenty-Sixth division of the A. E. F., is said to possess more medals than any other dog that saw service. He was decorated by General Pershing and added another claim for distinction recently by a visit to President Coolidge. The dog was wounded by shrapnel in 1918. On dress occasions, "Stubby" displays his medals on a comfortable blanket bearing sergeant's stripes and regimental emblems.

Veteran of the World War, Mascot "Stubby" Wears His Medals with Canine Dignity

Hair Remover Worked as Scissors Pulls with Rubber Bands

Superfluous hairs can be removed safely, it is claimed, with an instrument somewhat like a pair of scissors, with crossed rubber bands instead of the usual blades. As the handles are worked back and forth, the bands, rolling against each other, catch the hairs between them and extract them. If the skin is held tight and the hairs are not too long, little pain attends the process, it is said.

Hair Remover in Use, and Close View Showing How Bands Are Wound

Lathes That Cut Spiderweb Lines Prevent Banknote Frauds

Practically every government on earth is a customer of a little shop in New Jersey where the geometric lathes for engraving the patterns on banknote and similar plates are manufactured. Finely adjusted gears on the machines produce the closely interwoven curves, spirals and scrolls on the copper surfaces. The tool is so made that combinations of designs can be executed even to the intricate weblike borders. Hardly two lathes are made alike, each one being suited to the individual requirements of each purchaser. The extreme accuracy of these instruments makes it difficult to alter the notes without detection.

Harmonica and Trumpet Combined Easily Played by Chart

With only a few minutes of practice, it is claimed, anyone can learn to play tunes on a combination mouth organ and

With Aid of Instruction Chart, Children Easily Learn to Play Mouth-Organ Trumpet

trumpet. The instrument is about the same size and shape as a cornet. The tones of the harmonica, which is placed inside the horn, are amplified by the trumpet part which is slid back and forth as the breath is expelled or drawn in, according to directions carried on a visible indicator chart in front of the player.

Tree Rings Aid Weather Forecasts by Showing Rainfall Average

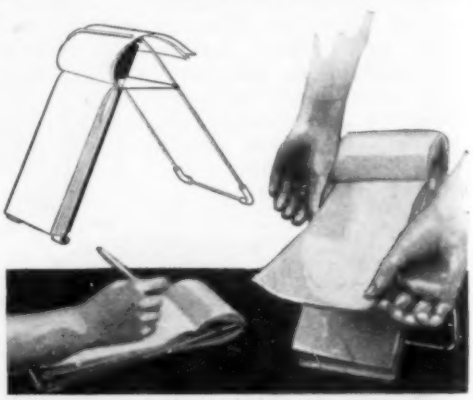
Age of trees and certain characteristics of their growth and development have been told for many years by means of the rings on the stumps, but these records are now believed to be of additional value as a basis for long-range weather forecasts in various sections. According to Dr. A. E. Douglass of the University of Arizona, there is a definite connection between these rings and the rainfall. Noting this relationship on a number of pine trees, he worked out the probable variations of the sun during the last four or five centuries and his deductions are said to have been corroborated by astronomers who have been studying the sun's spots. Knowing something of the changes that have occurred in the past, it is possible to make predictions as to the probable weather changes of the future, with the tree rings as the only known element in the problem. Study of the rings of the giant Sequoia trees, pronounced the oldest living things, will, it is expected, increase the accuracy of the forecasts and will yield data of weather conditions extending 3,000 years back.

Flashlight Is Fired by Radio Wave from Across the Ocean

Visitors at the annual wireless exposition in New York witnessed a brilliant illustration of radio magic when a wave, broadcast from the powerful station at Carnarvon, Wales, leaped the Atlantic and set off a flashlight-powder charge, taking a picture of Miss Helen Keller, Gen. J. G. Harbord, and Harold Bolster, director of the show, and other notables. The impulse was made to actuate an electrical circuit through a system of relays to ignite the powder, and at the same time an electrically controlled automatic camera took the photograph.

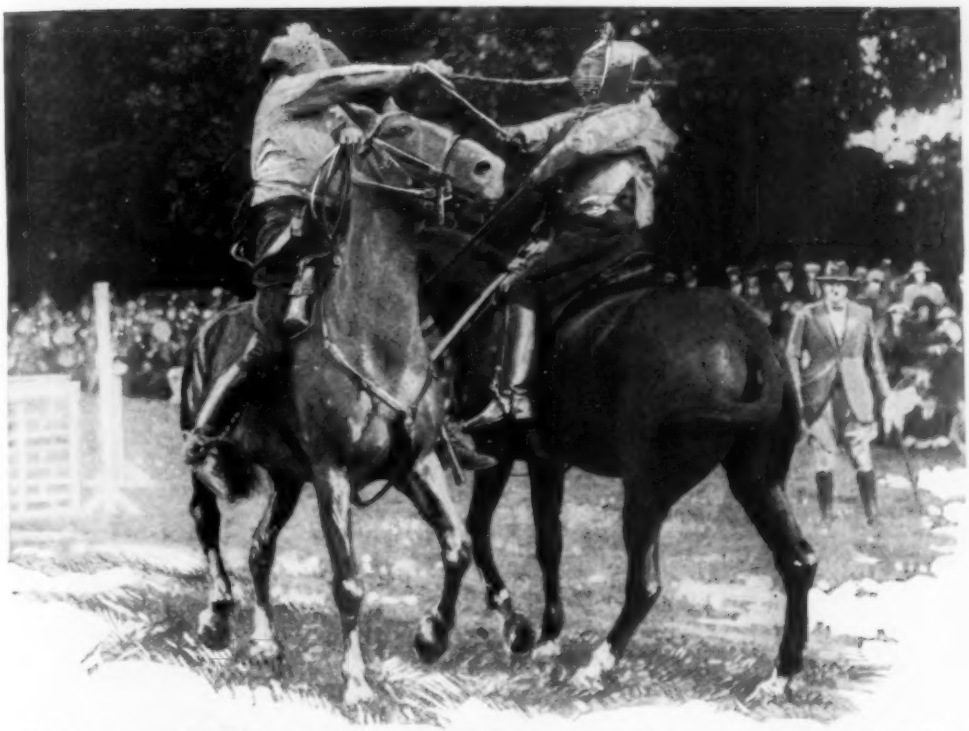
Holder for Notebook Aids Writing and Supports Pages for Typing

A folding portable copyholder which can be attached to a stenographer's notebook keeps the pages smooth for writing and supports the leaves upright for typing. Permanently fitted to the tablet, the device affords a solid rest for pen or pencil, and when set up on a desk for typewriting, permits the operator to retain an easy, natural position avoiding eye strain and fatigue.



Adjusting Holder to Notebook, Writing with It Flat, and Drawing of Upright Position

Almost any size of office stationery can be placed in the holder, and its ability to protect the sheets against crumpling under constant handling is said to result in a great saving of time and materials.



Fencing on Horseback, Called the "Balaklava Melee" after the Famous Charge of the Light Brigade, Is One of the Most Exciting Sports Used to Train Mounted Policemen for Rough Work

The Making of a Detective

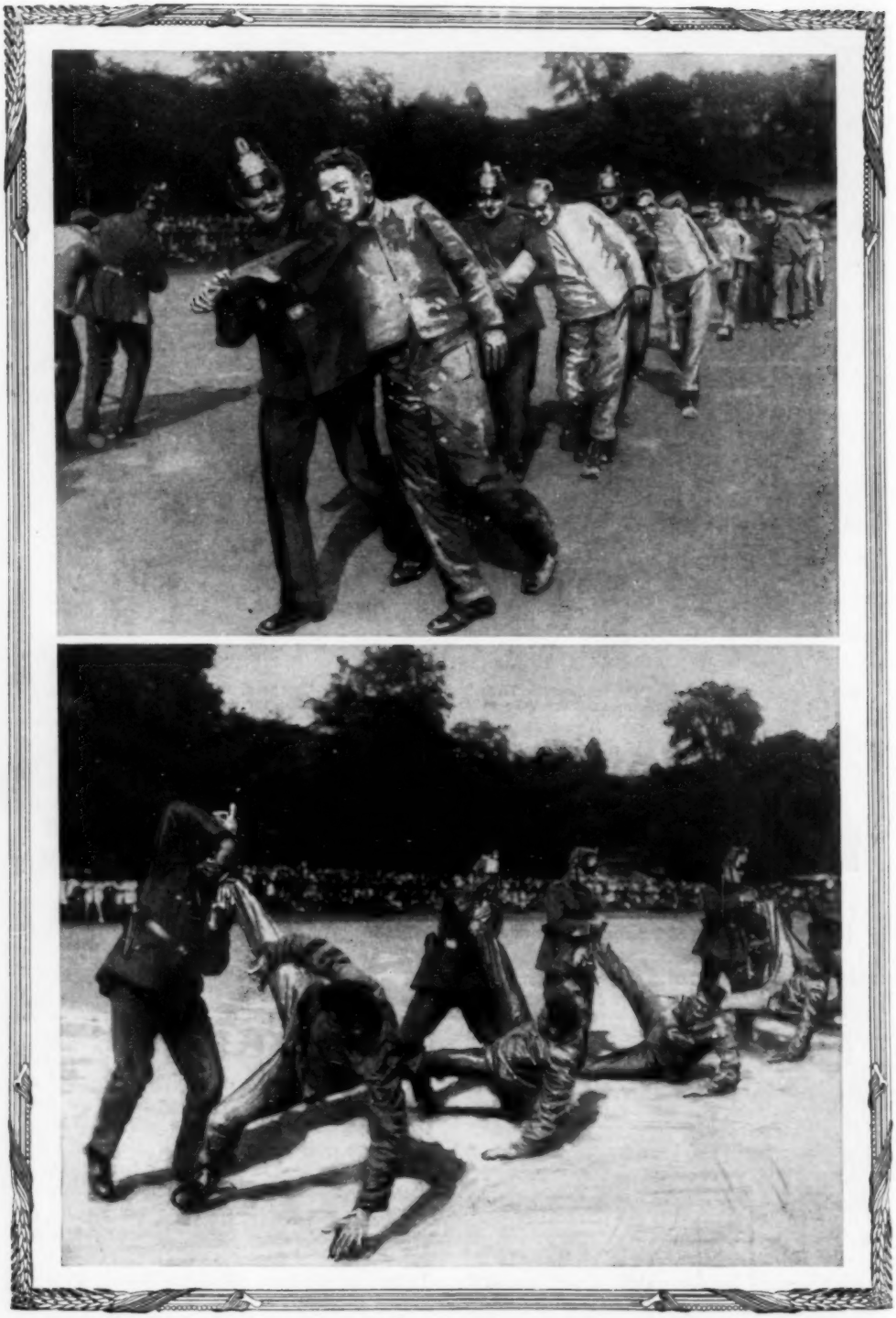
Vigorous Course of Physical Training and Plenty of Schooling in Scientific Methods of Unraveling Crime Required to Qualify

EVERY red-blooded boy at some time in his life aspires to be a policeman and ride a horse or motorcycle in the traffic squad, or patrol a beat in search of lawbreakers, picturing such a life as filled with excitement and adventure.

Yet a policeman's work is difficult and exacting and much of it is dull routine. First, there is a strenuous course of physical and mental training to prepare him for the lowest round on the ladder—walking a beat in uniform—and if he aspires to attain the aristocracy of the force and be a detective, in plain clothes, there is an even more vigorous bit of schooling.

The old days when a police officer's most severe work-out consisted in exercising an eighteen-inch locust stick have passed. The modern policeman is a slim, well-trained, clear-eyed fellow who can box, wrestle, ride, shoot straight, and who knows something about scientific criminology. The first training, which every aspirant for any branch of police work must take, is purely physical. The rookie is taught to stand and walk properly, with head up and shoulders back, and is then put through a course of hardening exercises to develop all the muscles. Most of the rookies during the last few years have been drawn from the ranks of former soldiers, men who didn't care to settle down to office work or routine jobs. Many of them are college graduates. They progress rapidly toward the higher branches, including work on special squads, such as traffic, narcotic, prohibition, bomb and detective-bureau work. Military training and college education tell, and the modern detective bureau includes many of these younger men.

Along with the new type of policeman have come many new methods of development. Nearly every big city now has its

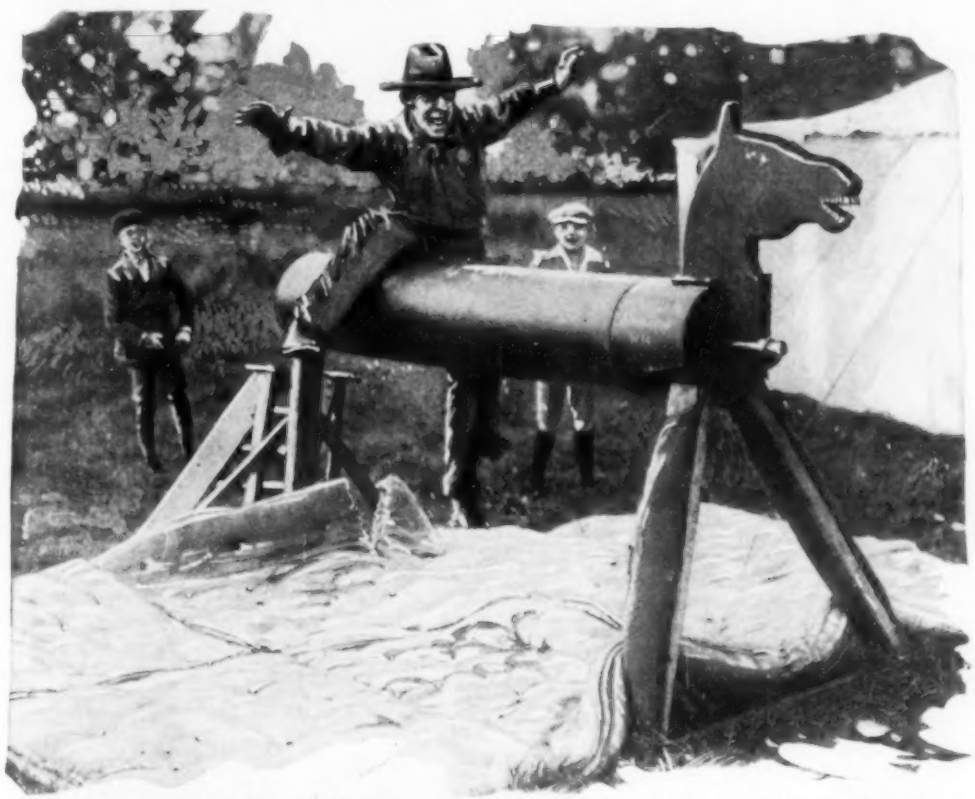


German Police Are Thoroughly Trained in Trick Holds for Rough-and-Tumble Fighting. Above, a Policeman Is Demonstrating an Arm Hold, While Below Is Shown One Similar to the Wrestler's Toehold

annual police games, where the men go through military-formation drills, cavalry stunts, setting-up exercises, trick motorcycle riding, and play polo and mounted pushball. Detective work takes an even harder training, though most of it is mental. Aspirants learn about fingerprints, how to find them and how to classify the telltale marks and locate the owner, if he has a police record, in the department files. They are taught the latest scientific quirks developed by clever thieves, and how to circumvent them. Modern crime detecting is based on a complete library of criminal information, consisting of all the detective reports on crimes committed over periods of many years. Each criminal has his peculiar vagaries which distinguish his work from that of all his fellows. The detective's job is to locate that peculiarity so that whenever it appears again the man responsible will be instantly identified. Besides all this technical knowledge, the candidate for a detective's job must know how to operate a typewriter to write his report, and attend to the clerical work which fills a large part of his spare time. Criminals are changing their technique constantly. Every new invention which aids humanity is turned to their own peculiar use. The automobile has made a quick get-away possible, and brought into being organized gangs who prey on pay-roll and bank messengers, or "stick up" outlying banks.

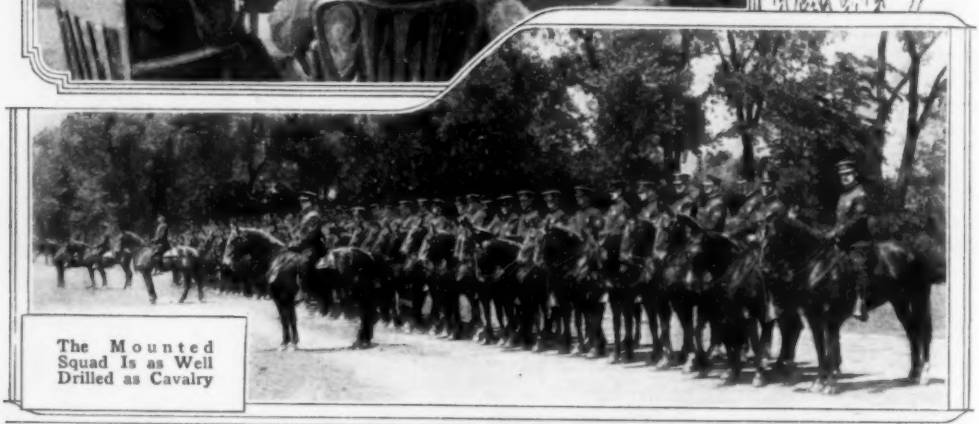
To meet these attacks in big cities, squads of detectives constantly cruise about in high-powered cars, armed with riot guns, machine guns and gas bombs. Experiments have even been made in equipping the detective cars with portable wireless outfits so that they may be instantly notified of a crime and kept informed, during the chase, of every report of the criminal's whereabouts. The detectives in those squads must not only be skilled trackers, expert rifle and pistol shots, familiar with the use of tear-gas bombs, but must even know how to operate a radio set, as well as an automobile.

The aim of modern police methods is, not to catch the criminal after the act, but know what he is going to do, and prevent it.



Policemen Are Trained to Ride This Mechanical "Bronc" Whose Body Revolves on an Axle. The Trick Is to Slide from the Tail to the Head without Falling

Detectives Must Master the Intricacies of the Whorls and Loops of Fingerprints and Learn to Distinguish One from Another Before They Are Eligible for Identification Work



The Mounted Squad Is as Well Drilled as Cavalry

Rookie Policemen Doing Their "Daily Dozen" at the Annual Field Games

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Red Is Still Best Danger-Signal Light Government Tests Reveal

Red, the traditional danger signal, is the best traffic light not only because the color has become symbolic of warning in the minds of almost everyone but because it can be most easily distinguished from other lights, bureau of standards tests reveal. Various colors were given daylight trials at different distances recently in connection with efforts of the bureau and other organizations to standardize traffic signals. Daytime was chosen, as correct identification is especially difficult in natural light. Using lamps of different candlepower and testing at distances up to 1,250 feet, it was found that red is the easiest to distinguish, green second and blue third. Ordinary yellow, though visible, was often mistaken for orange or red. The conclusions were drawn after several thousand tests with different observers had been recorded. It was shown, further, that, on the average, a red light of seventy-five candlepower could be identified at a distance of 600 feet, while green lights had to be 250 candlepower, yellow 750, and blue 1,000 candlepower to be distinguished at that distance. At 1,250 feet, the candlepowers required were 1,500, 2,500, 3,000 and 7,500, respectively.

Capture of Strange Bear Cub Ends Dispute of Scientists

The capture of a specimen of a unique species of small white bear on Princess Royal island, off the coast of British Columbia, has ended a twenty years' dispute among scientists. Until the animal was caught, many authorities had doubted that such a bear existed. It is smaller than its black cousin, and the teeth differ greatly from those of the polar family. The eyes are brown, which is declared proof of the fact that it is not an albino. The cub is now in the zoo at Victoria, B. C., and efforts are being made to trace the origin of the species.

Little, but Highly Important to Scientists—the Brown-Eyed White-Bear Cub in Captivity

Artificial Mouth Built of Rubber to Aid Dumb to Speak

That dumb persons may be taught to speak with the aid of an artificial resonator

Copyright, Keystone View Co.

Artificial Resonator with Rubber "Mouth" Designed to Aid in Teaching Dumb Persons to Speak

invented by Sir Richard A. S. Paget, is the belief of those who tested the ability of the device to magnify the human voice. The instrument is said to reproduce throat sounds by means of a rubber larynx in such a way that they can be formed into words by the "mouth" of the contrivance. It is easily carried and its operation readily learned by the user. During an experiment the resonator transmitted guttural sounds made by a subject and these were turned into words the patient desired to use, by manipulation of the lip piece.

¶Electric sirens for submarines have been invented by a Swedish engineer to prevent collisions of the boats and to warn other vessels to clear out of the way when the subs are about to return to the surface of the water.

Muff and Hand Bag Are Combined for Convenience of Shoppers

Another use for a muff besides keeping the hands warm has been found in a novelty called a bag-muff. It has an inconspicuous wrist cord at one end and a false bottom at the other, with a decorated tassel appended. When the left hand is removed, the muff falls open as a bag, placing the articles inside within easy reach. Bother of an extra carrier dangling from the arm is eliminated with this arrangement, and things are less likely to get lost than if placed loosely inside a muff.

Convenient as a Hand Bag with Wrist Cord, as Shown at Left, Accessory Fills All Requirements of a Warm Muff and the Tassel Adds a Decorative Touch

Uncle Sam's School for Lumbermen Aids Forest Conservation

Among the many activities in the public service maintained by Uncle Sam, is a school for lumber manufacturers and salesmen run in connection with the University of Wisconsin at Madison. Here, short intensive courses are given on the different properties of various woods, the best methods of handling them in factories and in preparing timber for the mills. Known as the forest products laboratory, this school already has been attended by nearly 800 persons from all over the country, and many firms find it profitable to send representatives to the classes each year. Included in the courses are demonstrations in the kiln-drying of lumber, building and operating the kiln being part of this work; studies in the proper boxing and crating of goods, with actual tests as to the strength of containers of various shapes and kinds of wood, and lessons in gluing. One of the chief objectives of the school, in addition to helping individual firms with their problems, is to teach the economical use of lumber and thus encourage conservation of forests.

Fountain Pen and Pencil in One

Combining a fountain pen and a self-sharpening pencil, a writing implement designed to save pocket space and conveniently provide either device when needed, writes with either end. The barrel is divided into an ink reservoir and a magazine for extra pencil leads. A lever is attached at the side of the stem for use in filling the pen, and the pencil shaft can be withdrawn to renew the point or use an eraser held in the concealed end. A protecting screw cap for the pen can be transferred to the pencil end when ink is being employed. Made in several different models, the device is strongly constructed with few parts to require renewal.

Sectional View of Combined Fountain Pen and Pencil Showing Ink Sack and Lead Magazine

One of Massive Colonnades Crowning Tiers of Seats in Chicago Stadium; Entrances Are Planned so That Capacity Crowds Can Vacate the Inclosure in a Few Minutes

Huge Stadium Covers Seven Acres and Seats Hundred Thousand

Occupying more than seven acres of land and planned so that all of its 100,000 seats command a clear view of the arena, the new stadium erected in Chicago is one of the largest amphitheaters in the world. With a greater capacity than the Colosseum of ancient Rome, the structure is provided with reception rooms, offices, dressing quarters for athletes and several large meeting halls. Built in the shape of a "U," the massive inclosure is open at one end to permit entrance of parades and pageants in unbroken column when necessary. Under the stand immense halls have been erected to accommodate indoor exhibitions and contests, while the open-air arena is equipped so that it can be flooded with water during the winter for ice skating. A temporary terrace of earth on the curve of the inclosure will be used to support extra seats when occasion demands, and parking space for automobiles will be available. The stadium is located in Grant Park on the shore of Lake Michigan.

Artist Molds Vases of Newspapers Softened with Paste

A sculptor, using old newspapers soaked in liquid paste for his clay, molded a large ornamental urn that rivals the beauty of carved metal and stone. Almost all of the work was done without the aid of tools and when the material dried a heavy coating of gilt was applied to give the appearance of a polished surface. Devoting his spare time to the task, the artist designed the most difficult scrolls and figures and worked in graceful patterns similar to those usually seen on marble and bronze ornaments. When completed the objects present a smooth, hard surface which can be readily painted and gilded in any variety of colors.

Artist Modeling Ornamental Urn from Old Newspapers Which Are Softened with Liquid Paste

Aluminum Drum for Banjo Head Amplifies Instrument's Tone

Banjo tones are said to be increased in volume by an aluminum resonator that fits over the head of any instrument from

Burnished Brightly, Resonator Adds Sparkle to Banjo as Well as Volume to Tone

ten to eleven and a quarter inches in diameter. The sounds are said to be projected and do not become muffled against the body. The drum is light and easily put on.

U. S. Plant Hunters Travel the World in Search of New Foods

The capital of the United States is the center of one of the most extensive and important research expeditions known to man — the department of agriculture's constant hunt throughout all parts of the world for plants and fruits that can be cultivated profitably here. In the last twenty-five years, these "Columbuses of horticulture" have been the means of introducing more than 58,000 varieties of grains, vegetables, forage crops and ornamental plants to American soil, and these imported finds are said to increase our farming turnover by more than $100,000,000 a year.

Durum wheat, sent from Russia a few years ago in two small sample packets and now yielding a 40,000,000-bushel crop worth approximately $50,000,000 yearly; Pima cotton, Sudan grass, and certain kinds of alfalfa and dates, are a few of the profitable crops that are now raised from specimens found by the government plant explorers in distant lands. Five testing stations are maintained where the new arrivals are cultivated before they are formally adopted. At Chapman field in southern Florida, a former war camp, 1,000 acres are devoted to experiments with various tropical plants; many fruits are given trials at Chico, Calif.; near Savannah, Ga., there is a bamboo-testing station; at Bell garden, sixteen miles from Washington, new plants are grown and examined for trace of disease, and at Bellingham, Wash., is a forty-acre tract devoted to the culture of bulbs.

Automatic Road-Crossing Barrier Safely Stops Fast Cars

An automatic highway barrier that drops into place from an overhead position when an approaching train enters an electrical circuit which operates the release mechanism, has been installed near Racine, Wis. It is claimed the safety gate will successfully stop automobiles traveling sixty miles an hour without injury to the cars or occupants. As the train leaves the crossing area the gates are elevated to their original position at the top of the supports. In addition to warning lights and gongs with which the structure is equipped, a preliminary caution is given unwary drivers by a "whiplash" bar that swings out over the roadway four seconds before the barriers fall. This device is placed about 150 feet from the main apparatus and is hung with lengths of

Safety Gate at Highway Railroad Crossing Which Drops as Approaching Train Enters Electric Circuit

rope and light pieces of bamboo, that brush across the top of a vehicle.

"Heave Ho!" and the "Bull Gang" Gives a Mighty Tug to Swing the Section Ends into Alinement

The Romance of the Pipe Line

Seventy Thousand Miles of Underground Conduits Used to Carry Nation's Liquid Fuel to Refineries and to Tidewater

THE average American citizen probably does not realize that one of the nation's mightiest systems of transportation functions day and night, winter and summer, but a few feet underground, with no whir of wheels to mark its pace and with never a shrill whistle to herald its ceaseless movement.

Yet, while train, trolley car, automobile and aeroplane whiz by on or above the earth's surface to the accompaniment of clang of bell or hum of motor, this prodigious subterranean transport system is carrying silently on at its task of moving, through more than 70,000 miles of metal pipe line, the golden flood of petroleum wherein lies latent the force to set the world's motors purring and the wheels of commerce turning around.

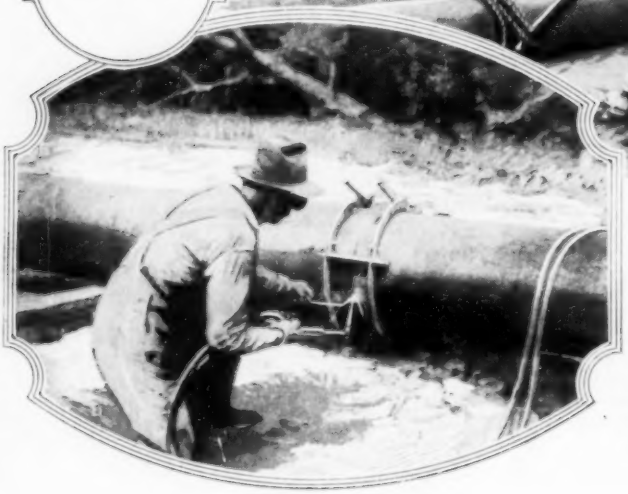
From the bleak Wyoming ranges, the valleys of the Montana Rockies, from the fertile plains of Texas, from the Oklahoma prairies and California's foothills, and from the lesser wells of Ohio, Pennsylvania and Kentucky, the liquid treasure pours from the field storage tanks down the pipes that traverse twenty states, en route to the refineries that dot the Atlantic, Gulf and Pacific coasts and the shores of the Great Lakes.

Born in 1863, four years after the first oil well was brought in, the pipe-line industry started in a modest way with a two-inch line, three miles long, to carry distillate from the Warren refinery to Warren's Landing, on the Allegheny river, where it was loaded on barges to float down to Pittsburgh. From that humble beginning it has grown, in sixty-one years, to 70,452 miles of pipes.

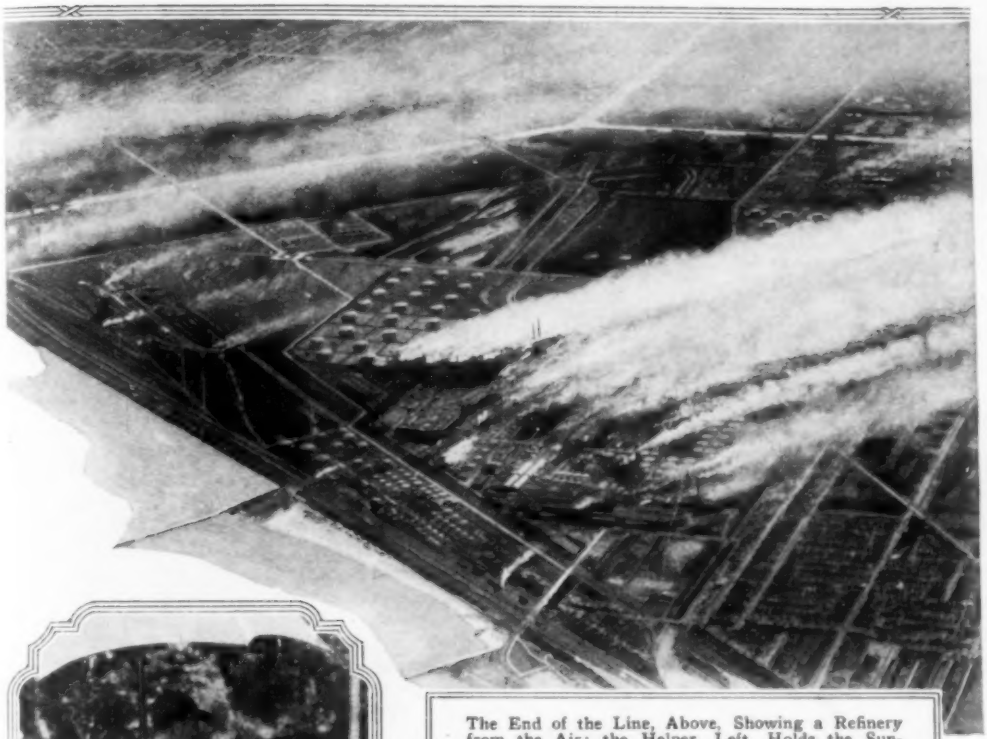
Through that vast network of pipes there flows more than 260,000,000 barrels of oil a year for delivery to distant refineries or the seaboard tanks where ships load for foreign delivery. Practically every barrel of oil produced in the United States—and production in 1922 totaled 557,531,000 barrels—makes part of its journey from well to market through the pipe lines. The beginning of the industry is a part of the romantic fight which convulsed the western Pennsylvania oil field in the sixties and seventies of the last century, when various interests contended for the control of the nation's oil business. The first pipe lines were short affairs built to circumvent the outrageous demands of teamsters who had controlled the business of hauling the oil from the wells to river landings or railroad points. The year 1863

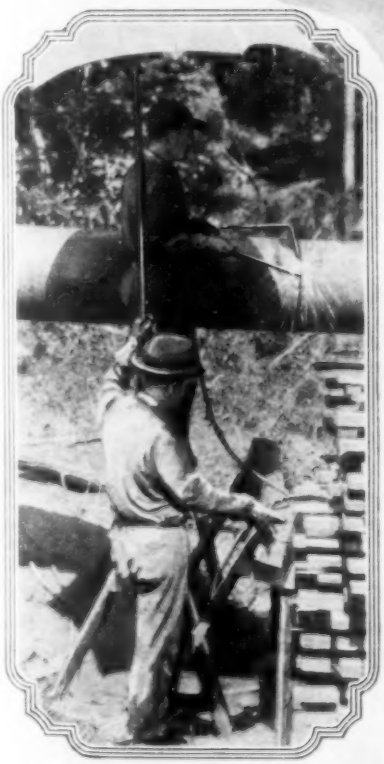
The Steam Cylinder of an Oil-Pipe Pump (Above) Is an Enormous Thing; at the Right, Workmen Alining the Pipe for the Welders

In Some Soils the Pipe Is Covered with Asbestos Paper or Coated with Tar to Resist Corrosion

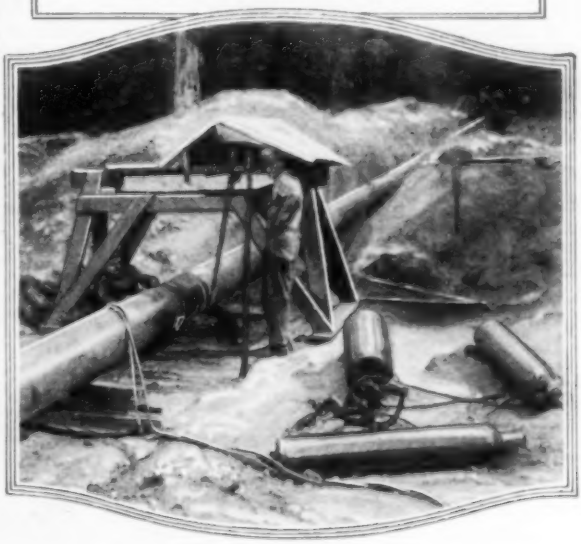


With the Ends Clamped in Place, the Welder, at the Left, Makes Several Short Welds, or "Tacks," to Hold the Joint; Then Removes the Clamp to Finish the Jo!





The End of the Line, Above, Showing a Refinery from the Air; the Helper, Left, Holds the Sunshade While the Welder Works on a Pipe Blocked Up to Cross a Gully; Below, Finishing the "Tie-In" of Completed Sections



saw the first three-mile line built at Warren, and likewise a two and one-half mile, two-inch line from the Tarr wells to Humboldt refinery at Plumer, Pa. By 1872 pipe lines had displaced the teamsters entirely for gathering the oil from the wells and carrying it to the shipping points. In that same year, which marked the start of the historic fight for control of the oil industry, the independent producers and refiners began considering a pipe line to the Atlantic coast.

General Herman Haupt, famous Civil War engineer, said it was feasible to pump oil over the Alleghenies and calculated the cost at sixteen and two-thirds cents a barrel, delivered at tidewater. His claims were ridiculed, and it was not until 1878 that a company was organized, obtained a right of way, and started building over the mountains. The first section was 109 miles long, from Coryville, on the edge of the Bradford field, to Williamsport, where the oil was transferred to the railroad pending completion of the line to the sea.

The day finally came for starting the pumps and a huge crowd gathered to see the experiment succeed—or fail. The line was six inches in diameter, crossed mountains 2,600 feet high, and had pumping stations about thirty miles apart. The pumps were started, and actually worked. Seven days later the first oil reached Williamsport. Modern lines are larger, though the majority are eight inches in diameter, yet with better pumps and higher pressures the rate of flow has been increased. Still, with lines stretching from distant Wyoming and Texas to New York the thick, greasy fluid may be four weeks or more on the road.

The early pipes were screwed together and frequently leaked. Then came flanged types, with packing in the flanges, but they too required daily patrol to watch for telltale seepage and make repairs.

The most recent development is the welded pipe, by which hundreds of miles of line are assembled in one piece, with all joints welded by oxyacetylene torches. Besides being cheaper and stronger than the other types, the welded pipe also has the advantage in speed in laying. One 180-mile job was completed recently in 100 working days, despite the handicap of heavy rains over several weeks, which reduced miles of the route to a swamp. Weather conditions were so bad that the acetylene generators, which produced one of the welding gases, had to be taken off their wagon mounts and placed on mud sleds. The pipe was welded together in sections of five, ten or twenty lengths, and the ends of the long pieces then joined as the ditching crew dug the trench and rolled the pipe in. The welded joints are so strong that cold bends are made as needed as the work progresses. In crossing wide rivers the end of a section was plugged and then floated into the stream, more joints being added as a windlass on the other side dragged it across, while the plug kept it afloat.

One of the longest of recent pipe-line jobs was the laying of the 720-mile line from the Salt Creek, Wyo., field to tap the main transcontinental line at Freeman, Mo. Laying the pipe is not the biggest part of a line company's work. Oil lines are common carriers, under interstate commerce regulation. They function like railroads. Producing shippers deliver their oil to the line at the well, and pay the freight for pumping it to the refinery to which it has been sold.

Some of the Valves through Which the Oil Is Routed to Fill the Various Tanks That Dot the Great Storage Fields Surrounding Every Refinery

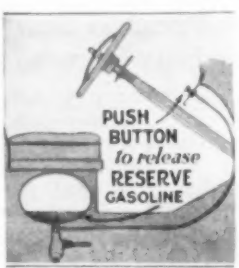
Seagoing Ship Steaming between Forested Shores at the Highest Point on the Gota Canal Which Carries Water Traffic from Gothenburg, Sweden, to the Baltic Sea

Ships Climb Hills and Cross Forests on Century-Old Canal

Conducting seagoing ships over a system of fifty-eight locks and carrying the craft 300 feet above sea level, the Gota canal in Sweden, built in 1832, affords a deep waterway, 354 miles long, across the peninsula, between Gothenburg and the Baltic. Although some of the natural streams that form the greater part of the route had to be deepened, only fifty-four miles of artificial channels were required to complete the water highway, which consists mainly of large lakes and connecting rivers. At the highest point on the canal, the stream is so narrow that tree branches brush the sides of the boats as they steam past wooded banks. The average time required to make the entire trip along the canal is two and a half days. The longest climb is accomplished between sea level and the 300-foot stage which carries the canal across the high hills to Lake Vener, and is made by means of twenty locks arranged on the order of a huge stairway. The boats are furnished to care for overnight passengers.

Reserve Valve for Auto Fuel Tank Is Controlled by Button

Running out of gas unexpectedly is prevented by a valve for the fuel tank that warns when the supply is low and releases a reserve that will last from twenty-five to thirty miles farther. It is installed above the sediment bulb and is controlled by a push button on the instrument board. When the tank is being filled, the button is pulled out. This closes an opening at the bottom in such a way that a reserve supply of gasoline is held below the main outlet. This is made available when needed by simply pressing the push button in again. Used in connection with the speedometer, the valve also furnishes a fairly accurate check as to the number of miles the car will make on a gallon of gasoline.



Assembling Ribs and Cover of Portable Boat; Hauling Entire Outfit on Homemade Truck, and the Craft in Use in Shallow Water Where Heavier Boats Would Stick

Collapsible Three-Passenger Boat Weighs Less than Fifty Pounds

For campers and sportsmen, a collapsible boat that will carry three passengers and their luggage and yet can be folded into a portable package weighing less than fifty pounds has been patented in Germany. Its framework consists of two sections of pliable staves over which a waterproof cover of rubber and canvas is stretched, the top and bottom being in one piece. As this material and the supports are flexible, there is little danger that stones or other obstacles will cause punctures in shallow water, and the boat remains rigid and safe at all times. It is made up to sixteen and one-half feet long, can carry from 385 to 440 pounds, is easily maneuvered and quickly assembled or taken apart. Two bags and a knapsack are provided for packing it, and the entire equipment can easily be moved on an improvised truck with round chair seats for wheels, arranging the paddles as handles for pushing or pulling the truck.

Piano with Magnets near Strings Produces Tones of Flute

By installing tiny electric magnets close to the strings of an ordinary piano, two French inventors have succeeded in causing the instrument to produce the tones of an organ, a flute or an oboe, it is reported. The magnets are controlled by tuning forks and the string is kept in vibration as long as the key is depressed. By disconnecting the keyboard from the electric circuit controlling the magnets, the piano can be played in the usual way.

Water Found Imprisoned in Crystal Ten Million Years Old

Clear and sparkling as though they might have just bubbled from a spring, drops of water more than 10,000,000 years old have been found by O. C. Farrington, head of the geology department of the Field Museum of natural history. They were imprisoned in crystal quartz picked up from rock formations in Brazil. The estimate of the age is based on the character of the rock which belongs to a period that, some scientists declare, flourished over 500,000,000 years ago.

Girl Wins Fame by Carving Figures from Blocks of Wood

Cleverly carved figurines, cut from pieces of wood with the aid of a jig saw and shaped into realistic models of persons, bits of furniture and other articles, have attracted considerable attention in London society and have won fame for their designer, an eighteen-year-old girl. One of her pieces was sent to Queen Mary for the elaborate doll's house exhibited at the Wembley exposition. Coloring the carvings with brilliant hues and tints adds to their attractiveness.

Cutting Patterns of Figurines Which Have Become the Latest Fad in London

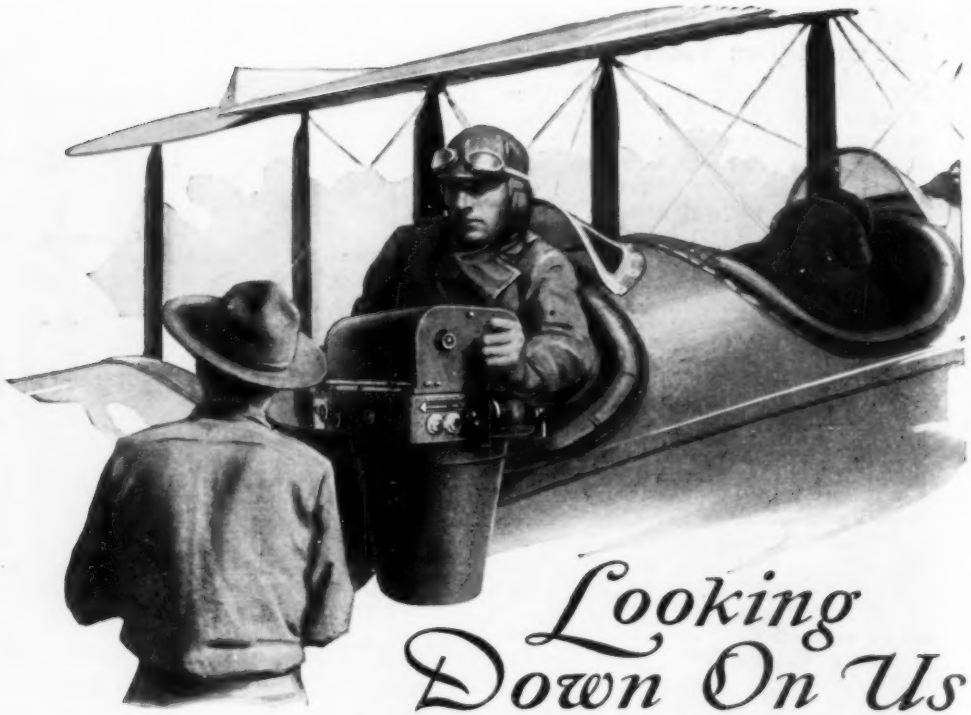
"High Water at Twelve Minutes of Seven" Is Warning of Beach Tide-Time Keeper

Clock That Tells Time of Tides Guards Visitors at Ocean Beach

Visitors at a bathing beach are provided with an effective warning against the run of the tides in a large clock dial with hands pointing to the hour when high water cuts off a group of rocks from the mainland. The spot is connected to the shore at low tide by a sand bar and is widely visited both by bathers and sightseers. Plainly visible at a considerable distance, the clock reminds persons on the rocks of the hour they must leave if they wish to avoid being stranded.

Pearls That Grow in Coconuts Valued as Good-Luck Charms

Among curiosities that recently have been reported from tropic lands are pearls which grow inside of coconuts. They are described as extremely rare, some about the size of a pigeon's heart and others only as large as a pea, and are brilliant white or yellowish. They are formed by the hardening of the embryo plant which solidifies when the shell is "blind," that is, when all three of the small depressions visible beneath the coarse fibers are closed too tightly to permit the maturing growth to push through. Natives of tropic islands value the pearls as charms to protect them against sickness and to give them success in business and war.



Looking Down On Us

Aerial Mapping Gives a Bird's-Eye View of the World and Creates a New Industry with Almost Limitless Possibilities

BORN of the necessities of war, the airplane camera has introduced a new and startlingly novel industry—aerial mapping and photography. In its lusty infancy it has already become an accepted, though none the less interesting, part of daily life. Five years ago there was no such thing as civilian aerial photographers. Now there are several important companies and many free-lance workers ready to fly anywhere and photograph anything. The credit for the amazing growth of the new business goes to the American army. When the armistice was signed, the military establishment had on hand large stocks of film, and as every amateur photographer knows, deterioration limits the life of unused film to comparatively few months.

The army decided it was better to "shoot" the film than to let it spoil, so set to work with a prodigal hand to use it all while it was usable. The resulting era of picture taking soon exhausted the supply of military fortifications, and the army flyers and cameramen branched out and "took" cities, farms, mountains and anything else that looked nice from the air.

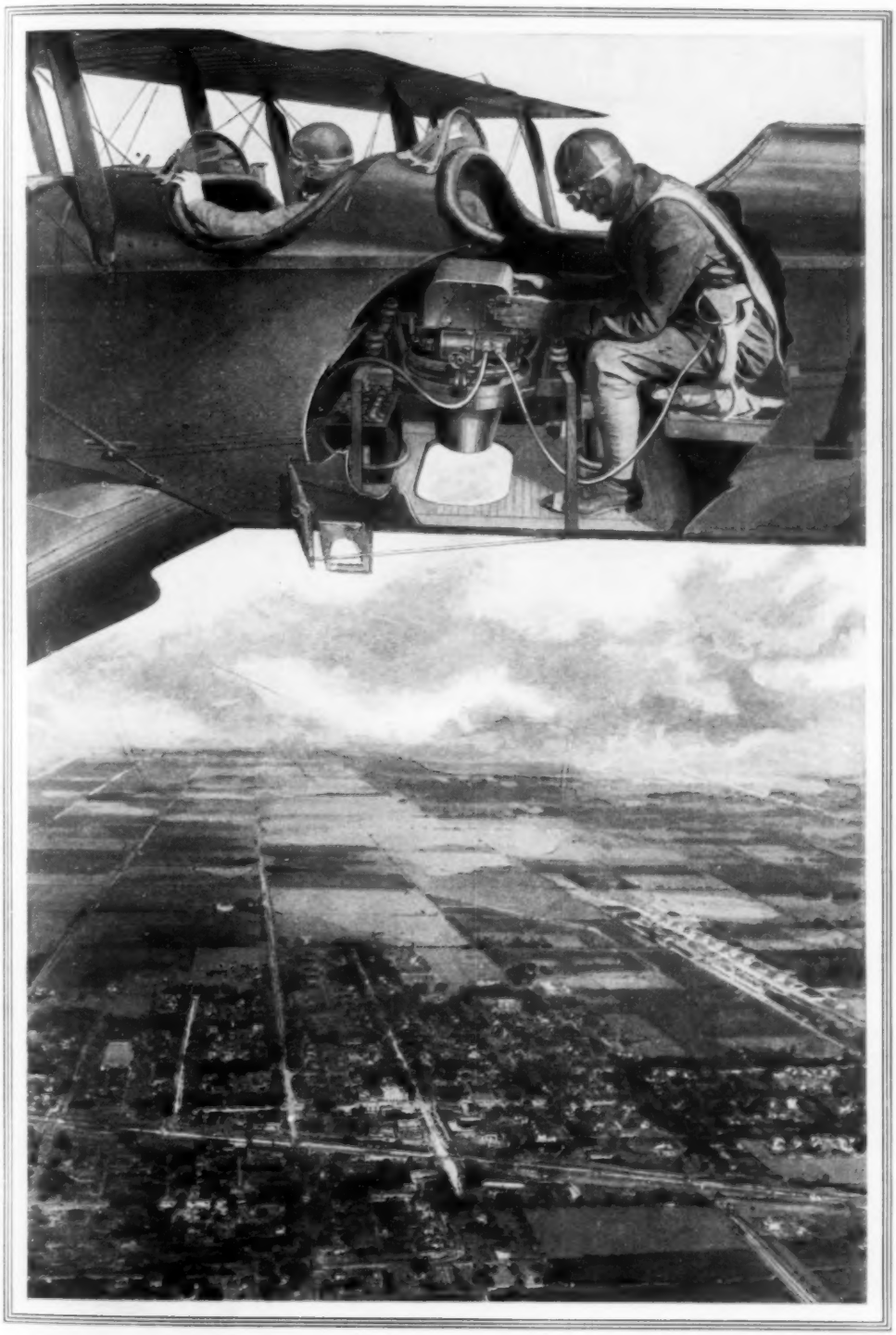
A complete aerial map of Washington was made. The skyline of New York, the birthplace of the nation at Philadelphia, the historic spots of Boston, Chicago's lake front and the snow-capped peaks of the Rockies all were filmed, and then the army proceeded to give the pictures to anyone who applied and had a legitimate use for them.

Newspapers and magazines used them freely, because of their novelty, and called for more. Chambers of commerce asked the army to come and photograph their towns, real-estate dealers applied for aerial pictures of their subdivisions, and individual owners for photos of their factories.

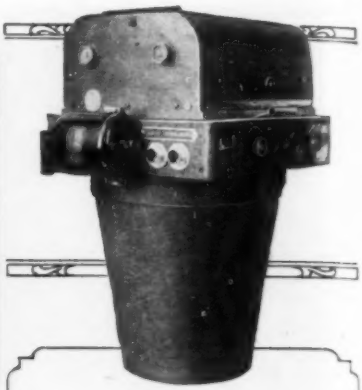
The government decided it was time to call a halt, but by that day commercial aerial-picture companies had grasped the opportunity.

With an accurate altimeter to show just how high the plane is flying and a table showing the area a camera of given focal length will cover at certain heights, it is possible to make an accurate survey of the ground while flying a mile a minute.

Using a camera of twelve-inch focal length, with films nine and one-half by

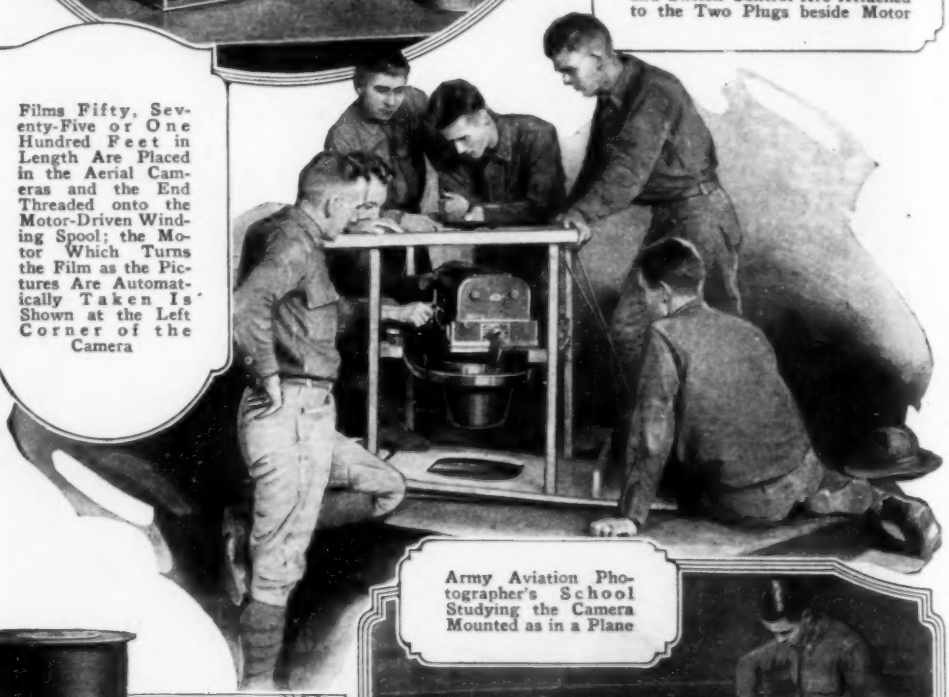


The Aerial Cameraman, 10,000 Feet in the Sky, Focuses His Motor-Driven Camera, Presses the Switch, and It Clicks Off Pictures at the Rate of One Every Thirty Seconds

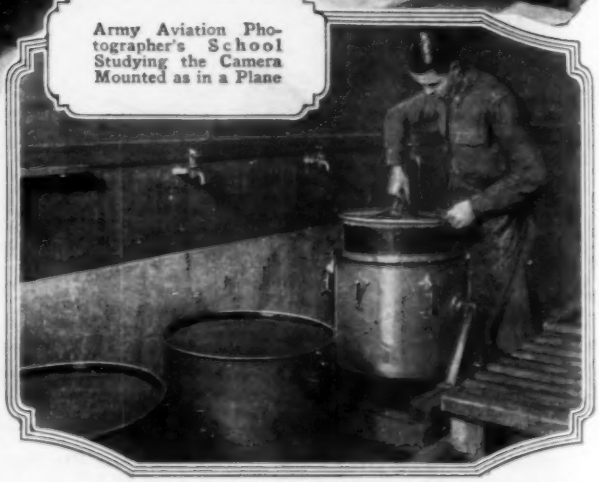


View of Camera with Film Holder in Place; the Battery Wire and Switch Control Are Attached to the Two Plugs beside Motor

Films Fifty, Seventy-Five or One Hundred Feet in Length Are Placed in the Aerial Cameras and the End Threaded onto the Motor-Driven Winding Spool; the Motor Which Turns the Film as the Pictures Are Automatically Taken Is Shown at the Left Corner of the Camera

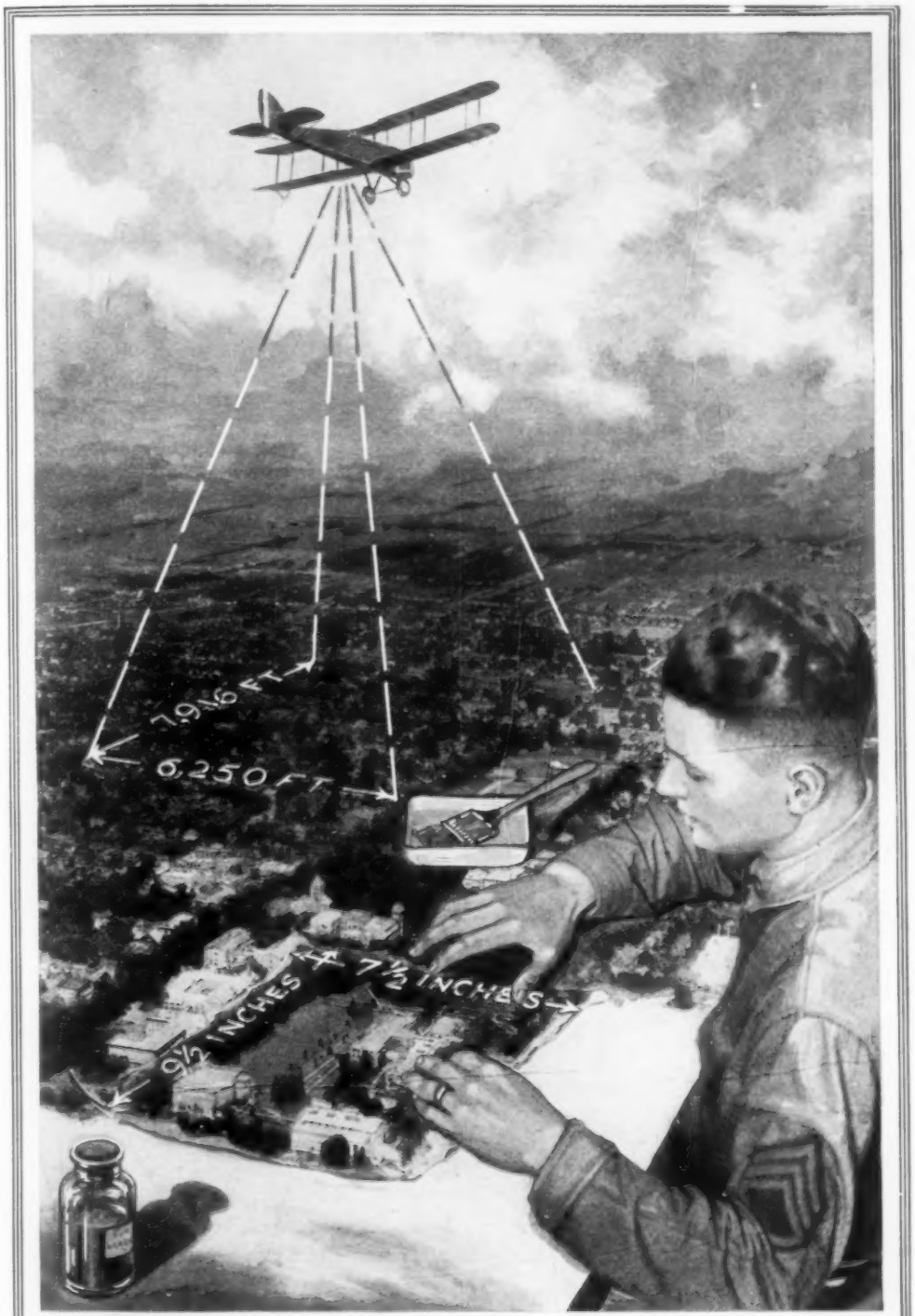


Army Aviation Photographer's School Studying the Camera Mounted as in a Plane



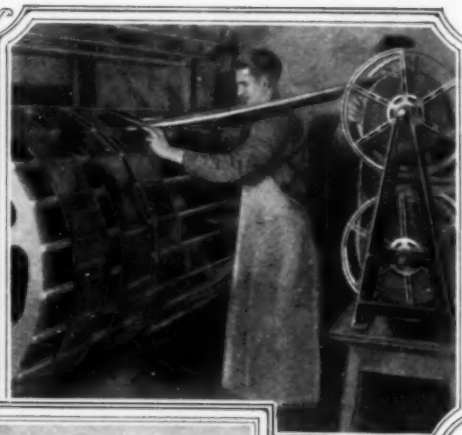
Aerial Film beside an Ordinary Kodak Roll Film, at Left, and Film-Developing Tank in an Army Dark Room at Rantoul Field School

Courtesy of the Army Air Service



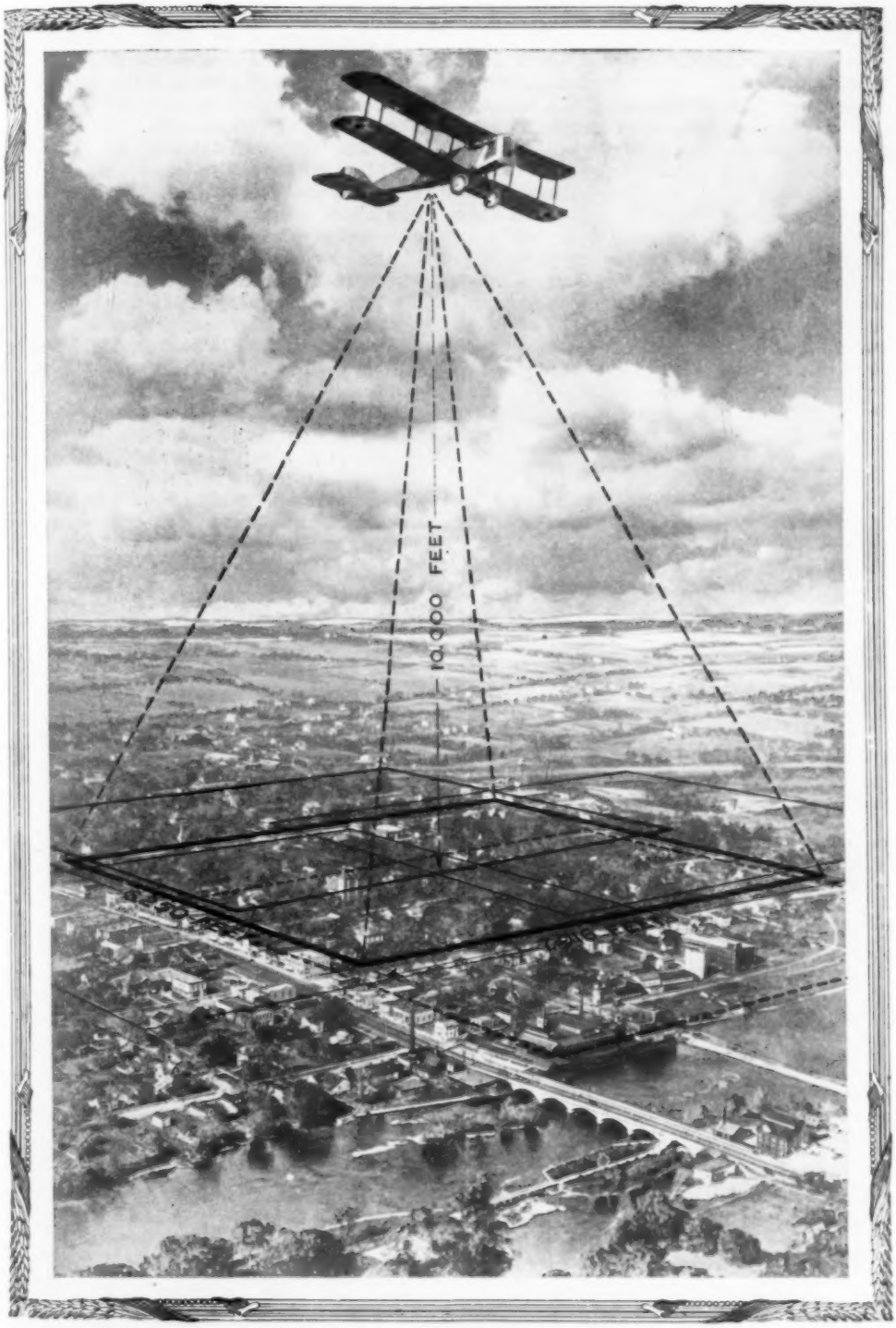
At 10,000 Feet the Camera Photographs a Plot 6,250 by 7,916 Feet, Making Small Picture, Which Is Then Pasted into the Assembled Map

The Roll Film Passes through the Printing Machine without Being Cut, the Operator Inserting a Sheet of Photographic Paper as Each Picture Appears



After Leaving the Developing Tanks and the Fixing Bath, the Films Are Unreeled onto Huge Drying Wheels, Big Enough to Take the 100-Foot Strips

Army Photographers Assembling the Hundreds of Separate Pictures Which Go into One Big Map, Showing Every Detail of Many Square Miles of Country



Aerial Cameras Are So Timed That Each Picture Overlaps Its Mates by Sixty Per Cent, Insuring Plenty of Margin for Matching the Edges as the Map Is Assembled

seven and one-half inches, and flying at a height of 10,000 feet, a picture is obtained that covers a ground space 7,916 feet by 6,250 feet. Any desired ratio can be worked out by changing the altitude. One aerial photographer recently mapped a new drainage district several miles long, on a scale of 500 feet on the ground to each inch on the picture. His camera table gave the correct altitude, and in less than five minutes he completed a job that would have taken a surveying party several days. Moreover his aerial map showed details no surveyor on the ground could have indicated. The sky mapper waited until after a rain had soaked the ground, so that every low spot in the fields, where water had collected, showed up darker than the surrounding higher ground, giving an accurate map of how the land lay.

Flying back and forth on parallel courses a little more than a mile apart, an aerial mapper at an altitude of 10,000 feet can easily survey a tract fifty miles long by ten miles wide in a day, covering 500 square miles. The parallel trips are close enough together so that each picture in one row overlaps its mates on either side. After the prints are developed they are matched up and pasted together, and, if desired, the entire map can then be rephotographed as one unit.

If less detail is desired, the plane can fly at a higher altitude and cover much more territory in a day, as each picture will show more ground area. One army air-service photographer took a picture of the city of Dayton from an altitude of 31,540 feet, the single photograph covering nineteen square miles of ground and showing every street and building clearly. At that great height the airplane was no longer visible from the ground, but the camera's eye functioned perfectly.

Aerial pictures are being used by city-planning experts to show clearly the improvements which can be effected by cutting new streets, straightening or moving streams, or widening traffic arteries, and insurance companies have enlisted the air camera to aid in fire fighting by showing the condition of building roofs and of the streets surrounding the structures.

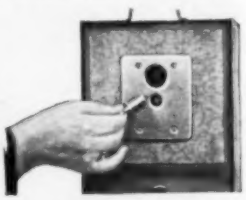
Streets, Parks, Rivers, Houses and Factories as They Look in an Aerial Picture Taken from a Height of 10,000 Feet—Nearly Two Miles in Air

Airplane and Radio Forest Patrols Reduce Yearly Fire Losses

Organization of airplane and radio patrols into a state and federal system to fight forest fires, which cause an annual loss of approximately $20,000,000 and devastate 10,000,000 acres, is being urged to save our timber resources. Successful in war operations, aircraft in the hands of flyers of the army air service already have demonstrated their efficiency in combating man's greatest peace-time enemy. In one season, seventeen planes, patrolling the air above national forests in California, spotted 442 fires in time to summon ground crews to the scene before extensive damage was done. In Oregon, two planes on a patrol commanded by Capt. Lowell Smith, leader of the world flight, discovered 128 fires in nine weeks. With portable radio outfits by which crews can be assembled in short time, the service of the aerial observers is greatly increased. Campers and travelers are said to exercise greater caution when they realize that they are being watched from the air by vigilant forest patrolmen and hesitate to leave embers burning or start fires.

Gas Socket Flush with the Wall Has a Removable Key

As an improvement over the projecting gas supply pipe for hose connections, a socket arrangement that is shut off or turned on with a removable key has been devised. Fitting flush with the wall, it is out of the way, attractive in appearance and cannot be opened by accident, thus preventing chance leaks and the danger of children tampering with it.



Postage Meter's Electric "Tongue" Out-Licks Flock of Boys

Combining a letter sealer with an automatic postage-stamp device, all in one unit, a new office accessory licks, seals and stamps more letters in one day than a whole flock of office boys. Operating on the metered-service system, whereby the post office department sets a locked meter to print a given number of stamp permits on the envelopes, the device removes all chance of petty pilfering of stamps. By combining the letter sealer with the stamp machine, one operator can do the work of two, and run the mail through in half the time.

Fed into a Hopper, Letters Are "Licked," Sealed and Stamped at Rapid Rate in This Electric Unit

Parts for Autos "Coined" in Presses to Speed Production

Presses, not unlike those used for many years to stamp out coins, are employed in large automobile factories to reduce costs and enable rapid production of small parts. They save a large number of hand and machine operations and turn out work of uniform quality. Some of them are said to have a capacity 900 per cent greater than is possible by ordinary methods.

Cranberry Picker Run by Tractor Cuts Loss of Spoiled Fruit

Mounted on six rubber-tired wheels and propelled by a light tractor engine, a mechanical cranberry picker has been invented to save time and reduce the cost of harvesting the crops. The machine is built somewhat like a giant tricycle with a single wheel for steering in front. As it passes over the bog, rows of closely placed steel fingers, like the teeth of a comb, sweep through the bushes, picking the berries and depositing them on a canvas belt which carries them to a box. One of these tractors is said to do the work of a large number of hand pickers and only the plump, fully developed berries are removed, the shriveled ones being too small to be caught by the fingers.

Tractor Cranberry Picker in Operation, Steered by a Single Large Front Wheel, While Revolving Rows of Teeth Remove the Fruit

End Fog, Bring Rain by Shooting Clouds with Sand

Using electrified sand thrown by centrifugal force through nozzles on the fuselage of their airplanes, aviators testing a process for dispersing fogs, "shot down" several accumulations of clouds overhanging the field above which the experiments were made. Under the spray of silica, which was devised by Dr. L. Francis Warren of Harvard university, small clouds faded away entirely while larger masses were pierced and crossed by wide swaths cut into them by the blasts of sand. Although forced to climb 13,000 feet to a stratum of mountainous clouds, the flyers could be discerned from the ground by aid of glasses, cutting paths and gorges through the massive formations. Projecting portions were quickly dissipated as the machines circled the mists or dived into the fringes of the vaporous shapes. Operations were carried on against a section of a large bank of storm clouds with the result that lightning which had been flashing regularly through the dark mass ceased altogether and a fine gentle rain fell for more than four hours, unaccompanied by the thunder and electrical displays usually occurring during such storms. It is thought the process might be employed to clear aviation landing fields of blinding fogs or to cut lanes through the formations so approaching planes can be guided safely to the ground. Similar uses could be made of the sand blasts, it is said, to permit steamships to enter fog-wrapped harbors. Two large aircraft equipped with sanding apparatus are estimated to be sufficient to quickly relieve London, where a day of fog is said to cause a loss of $5,000,000.

Furniture Is Fumigated in Vault to Kill Moths and Pests

Fumigating large pieces of upholstered furniture, pianos, carpets and other bulky articles to kill moths and other pests is

Removing Large Divan from Vault Where It Has Been Fumigated for Twelve Hours

made possible by a roomy air-tight vault. The things to be treated are placed inside, the doors sealed, and for twelve hours the contents are subjected to a bath of fumes calculated to destroy insects of all kinds and their eggs. The process can be used at night, thus saving the time of workers, and the fumes do not spread to other parts of the storage rooms.

"ZR-3" Engines Stop if Oil Gets Low

The five engines built in Germany for the "ZR-3," last of the Zeppelins and now the "Los Angeles" of the American navy, have several novel features, not the least of which is a device that automatically stops the motor when the oil pressure at the bearings drops below a safe point. The engines were specially designed for commercial aircraft service, and light weight was sacrificed in favor of sturdy construction which would eliminate the necessity of frequent overhauling. The motors are of the twelve-cylinder V-type, with a single camshaft between the two rows of cylinders. Four carburetors are placed between the cylinder blocks, while each six-cylinder bank has a separate muffler. Another unusual feature is the provision for reversing the engine by shifting the single camshaft. Safety devices insure that the engine can be cranked only in the direction for which the camshaft is set, and that the reversing gear can be employed only when the throttle valve is locked in the closed position. Each cylinder is equipped with two spark plugs, while the magnetos operate equally well for either direction of engine rotation, the readjustment of the timing taking place automatically. Another unusual thing about the airship which will interest motorists, is that the water ballast must be doped with an anti-freeze solution because of the cold at high altitudes.

Big Trees That Baffle Inventors Cut by Old-Time "Buckers"

Despite the development of power-operated saws for felling trees, lumberjacks working among big specimens in Oregon

Timberland "Buckers" with Saws and Axes Cutting through the Trunk of a Giant Tree Too Large for Power Tools

resort to the old-time saws and axes to bring down the forest giants. Although cutting machines have supplanted the "buckers" with their two-man saws in many timberlands, strong-arm methods seem to be the only means of chopping through the massive trunks of the larger trees. Their bases are so wide that machine saws can not be operated to insure fall in the right direction. Axes are first used to remove the deep thickness of bark before saws can be applied, and much labor is required to "skin" the logs of the tons of rough covering in preparing them for shipment to the mills. Many such trees grow in the forests of the Pacific slopes.

Loading the Gas and Air Chambers of a Light and Whistle Buoy That Operates for Three Months on Single Charges from a Tender Ship Which Carries Generating Plants

Supply Depot of the Lighthouse Service Where Faithful Tender Craft Fit Out for Patrols and Take on Fuel and Provisions for Maintenance of Silent Sentinels of the Seas

Night Watchmen of the Sea

Fearless Men on Lonely Lightships and Isolated Towers Keep Beacons Burning to Guide Ships Safely through the Dark

ROLLING and groaning under every breaking sea, with giant anchor chains rasping shrill protest against the tugging weight, forty-seven American lightships keep vigil day and night throughout the year over the dangerous shoals that dot our coasts and the inland seas. They are the far-flung advance line of the 17,000 aids to navigation. Manning the lightships at sea and the lighthouses on islands, rocky reefs and ashore, is the world's greatest organization devoted exclusively to saving life and property on the high seas.

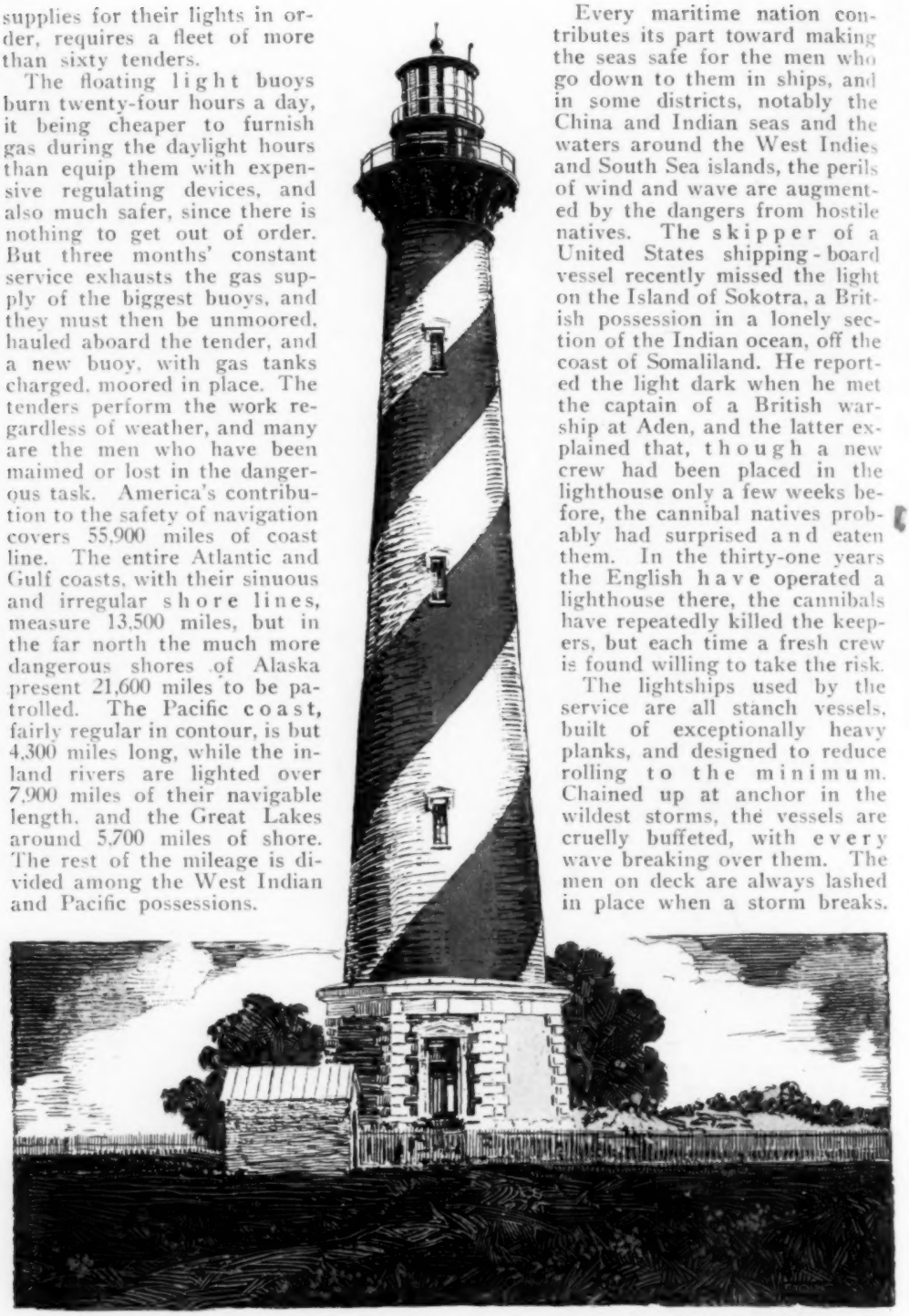
On every lightship a crew of two to three officers and ten to a dozen men keep ceaseless watch to warn shipping away from danger, and rescue those in distress. The hardest life on the seas is theirs, with two months on constant duty and one month ashore with friends and family—always providing that storms abate and permit the relief tender to come alongside on time.

Crowded in the two months aboard ship is more hard work and more danger than the average sailor sees in a year's time. The lightship's one duty is to stay chained to its hidden reef and broadcast its warning, a light by night and a bellowing horn in time of fog. When storms come up, the lightship cannot cut its anchor chains and ride away before the wind. It must stay on the job as long as it will float, and if it sinks the crew stand every chance of going down with their ship. To keep forty-seven vessels on guard the lighthouse service maintains sixty ships, a margin of thirteen to be in port for repairs.

Besides the lightships and lighthouses the service operates 6,000 lesser lights, 600 fog signals, 153 buoys with fog whistles, 397 buoys with signal bells, eight radio-signal stations and thousands of minor floating lights, bells, whistles and plain metal or spar buoys. To keep them all in repair, anchored in place, and with gas

supplies for their lights in order, requires a fleet of more than sixty tenders.

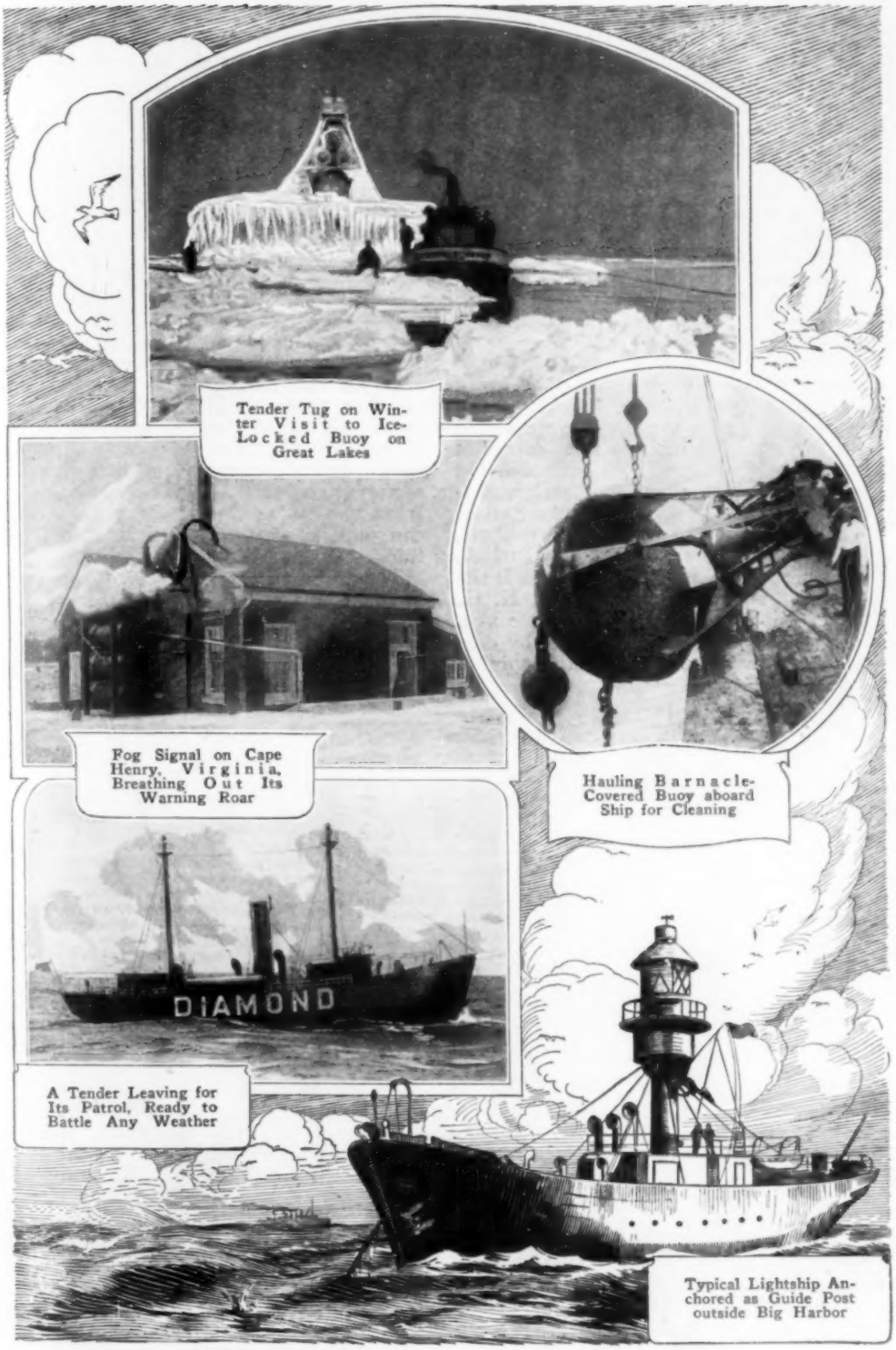
The floating light buoys burn twenty-four hours a day, it being cheaper to furnish gas during the daylight hours than equip them with expensive regulating devices, and also much safer, since there is nothing to get out of order. But three months' constant service exhausts the gas supply of the biggest buoys, and they must then be unmoored, hauled aboard the tender, and a new buoy, with gas tanks charged, moored in place. The tenders perform the work regardless of weather, and many are the men who have been maimed or lost in the dangerous task. America's contribution to the safety of navigation covers 55,900 miles of coast line. The entire Atlantic and Gulf coasts, with their sinuous and irregular shore lines, measure 13,500 miles, but in the far north the much more dangerous shores of Alaska present 21,600 miles to be patrolled. The Pacific coast, fairly regular in contour, is but 4,300 miles long, while the inland rivers are lighted over 7,900 miles of their navigable length, and the Great Lakes around 5,700 miles of shore. The rest of the mileage is divided among the West Indian and Pacific possessions.



Every maritime nation contributes its part toward making the seas safe for the men who go down to them in ships, and in some districts, notably the China and Indian seas and the waters around the West Indies and South Sea islands, the perils of wind and wave are augmented by the dangers from hostile natives. The skipper of a United States shipping-board vessel recently missed the light on the Island of Sokotra, a British possession in a lonely section of the Indian ocean, off the coast of Somaliland. He reported the light dark when he met the captain of a British warship at Aden, and the latter explained that, though a new crew had been placed in the lighthouse only a few weeks before, the cannibal natives probably had surprised and eaten them. In the thirty-one years the English have operated a lighthouse there, the cannibals have repeatedly killed the keepers, but each time a fresh crew is found willing to take the risk.

The lightships used by the service are all stanch vessels, built of exceptionally heavy planks, and designed to reduce rolling to the minimum. Chained up at anchor in the wildest storms, the vessels are cruelly buffeted, with every wave breaking over them. The men on deck are always lashed in place when a storm breaks.

Cape Hatteras Light Station, Nearly 200 Feet High and Painted in Barber-Pole Design for Daylight Identification, Stands as a Warning Sentinel to Mariners Far at Sea; at Night and on Dark Days Its Powerful Beacon Guards the Dangerous Shores



Tender Tug on Winter Visit to Ice-Locked Buoy on Great Lakes

Fog Signal on Cape Henry, Virginia, Breathing Out Its Warning Roar

Hauling Barnacle-Covered Buoy aboard Ship for Cleaning

A Tender Leaving for Its Patrol, Ready to Battle Any Weather

Typical Lightship Anchored as Guide Post outside Big Harbor

Most of the light vessels use oil lights at the top of their tall signal masts, though some have been equipped with gas and others with electricity.

Life on board is not one continuous round of duty, the men standing regular sea watches, and as a result the off-watch period for many years was the worst of all, for it was then that the lonely isolation was most keenly felt. Now the radio, and circulating libraries brought out by the tender, relieve the monotony.

Radio and books also have brought relief to the keepers and their families in the lighthouses on lonely islands, reefs and secluded parts of the coast.

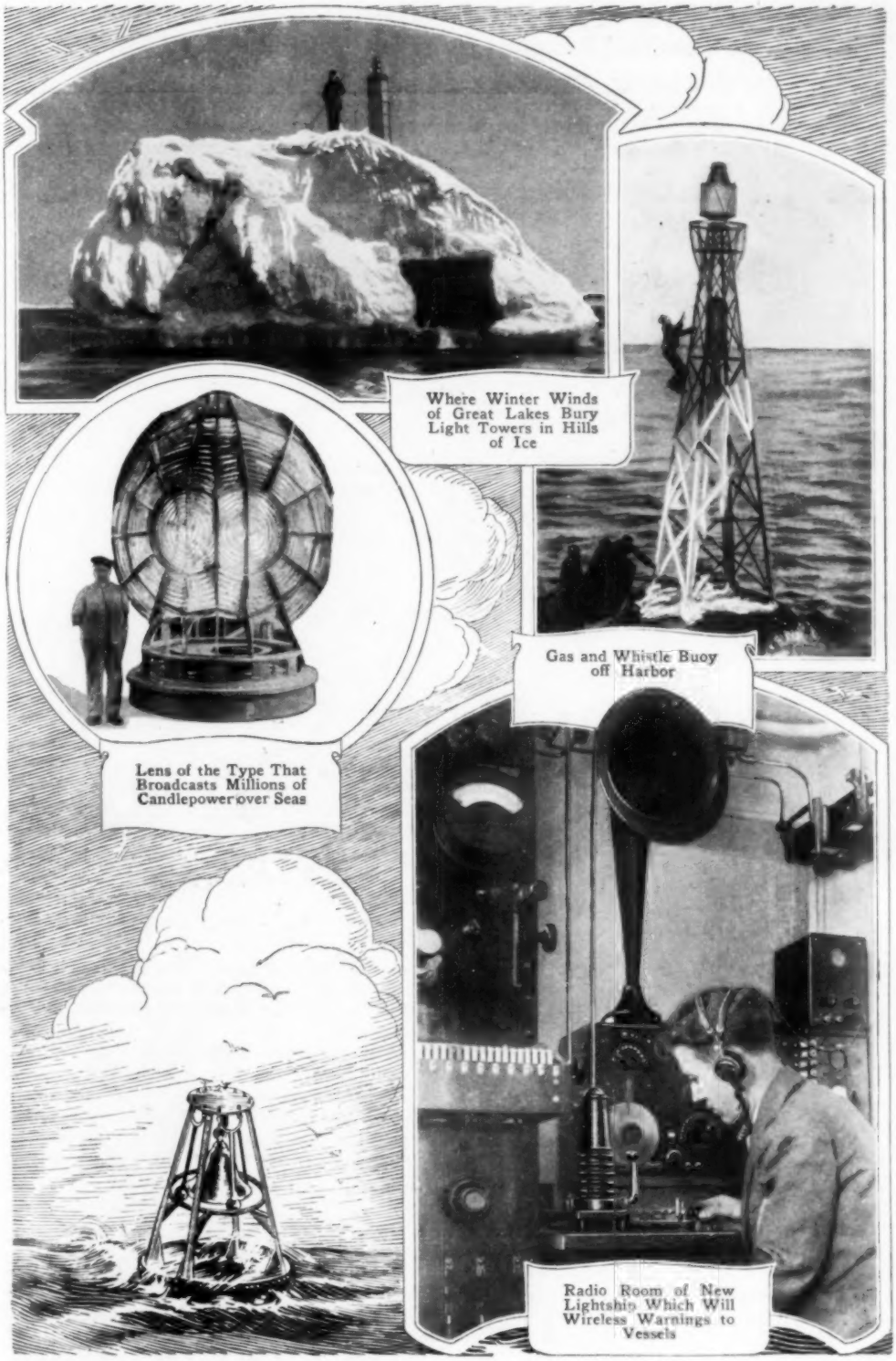
Like the ships, the lighthouses are built to withstand the raging seas that break about their bases. The height of the towers varies with the importance of the light and the condition of the shore, but all are strongly built of rock and steel. On the Atlantic coast, where the beach is usually low, are found the tallest towers, while on the headlands of the Pacific, a short, squat tower on some bluff usually suffices. The tallest of American lighthouses is the 193-foot tower at Cape Hatteras, N. C., which is striped like a barber's pole as a distinguishing mark for mariners by day. The world's worst storms, in the opinion of seamen, blow at the dangerous shoals of Hatteras.

So far as brilliance goes, the great 710,000-candlepower beam on the Atlantic highlands at Navesink, N. J., leads them all. Its rated brilliancy is visible twenty-two miles at sea, and even farther in good weather.

The biggest lighthouse lens, however, is at Makapuu Point, Oahu, Hawaii, where the huge glass has a diameter of nearly nine feet, inclosed in a sixteen-foot lantern. The highest light of all is at Cape Mendocino, Calif., 422 feet above water level, but its tower is not important, as the height is due to the cliff on which it stands. Besides the lights, the lighthouse and lightship men now operate radio directional sets and send submarine warnings, as well as radio fog warnings and weather reports. The lighthouses near main steamer channels into important harbors have been equipped with one-kilowatt wireless sets operating on a thousand-meter wave length. With cross bearings from two or more lighthouses, a vessel can find its way unerringly through the thickest fog or the darkest night.

The submarine signals are sent out through an underwater tube from the lightships and picked up by submarine receivers on passing ships, a system of Morse signals serving to identify the lightship, while the direction of the signals indicates its location.

How Gas Buoys Are "Captured" and Moored to a Vessel by the Attending Crew, Who Test the Supply of Fuel with a Gauge They Apply to the Valve of the Lamp's Reservoirs



Where Winter Winds of Great Lakes Bury Light Towers in Hills of Ice

Gas and Whistle Buoy off Harbor

Lens of the Type That Broadcasts Millions of Candlepower over Seas

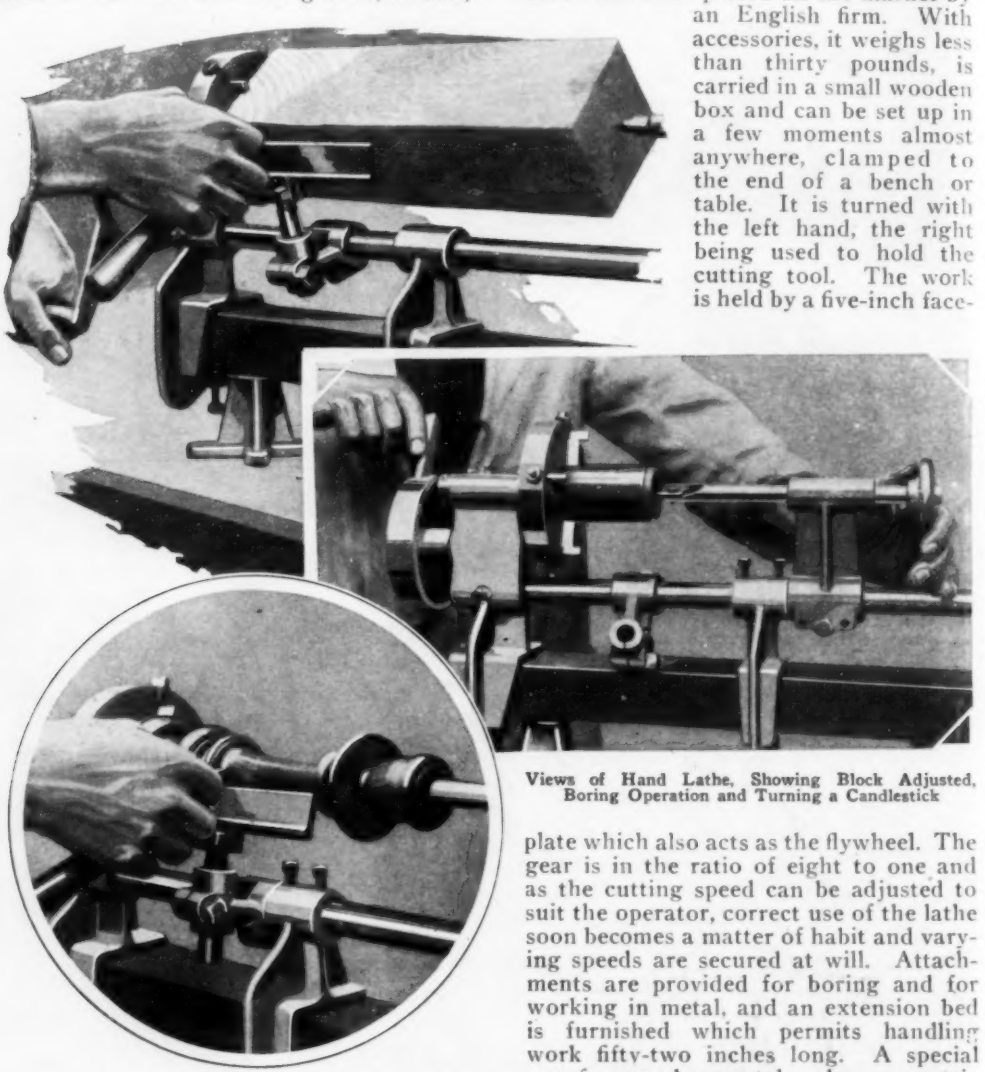
Radio Room of New Lightship Which Will Wireless Warnings to Vessels

Find Ocean Depth of Over Six Miles without Touching Bottom

Fifty miles off the coast of Japan what is said to be the deepest spot yet located in the ocean was recorded from a Japanese man-of-war with a sounding of 32,644 feet, or nearly six and a quarter miles. How much deeper the sea bed lies at this point is not known, for the wire was not long enough to reach farther. The greatest depth previously recorded is off the coast of Mindanao in the Philippine islands, where bottom was reached at 32,113 feet. This is known as the Philippine Deep. The deepest "hole" in the Atlantic, 27,965 feet, is north of Porto Rico.

Hand Lathe with Direct Gear Drive Is Portable and Quickly Set Up

For a wide variety of wood-turning work, a small hand lathe with a direct gear drive instead of the usual belt transmission has been placed on the market by an English firm. With accessories, it weighs less than thirty pounds, is carried in a small wooden box and can be set up in a few moments almost anywhere, clamped to the end of a bench or table. It is turned with the left hand, the right being used to hold the cutting tool. The work is held by a five-inch face-plate which also acts as the flywheel. The gear is in the ratio of eight to one and as the cutting speed can be adjusted to suit the operator, correct use of the lathe soon becomes a matter of habit and varying speeds are secured at will. Attachments are provided for boring and for working in metal, and an extension bed is furnished which permits handling work fifty-two inches long. A special saw for wood or metal and an eccentric chuck for ornamental designs are also provided with the lathe if desired.



Views of Hand Lathe, Showing Block Adjusted, Boring Operation and Turning a Candlestick

Insects Give Off Rays?

The possibility that many insects emit ultraviolet rays just as fireflies give off visible light, was discussed not long ago by eastern scientists. According to Prof. Edmund Newton Harvey, of Princeton

university, the theory is not improbable, and it is likely that the rays can be seen by other insects with eyes differing from those of human beings. Plates like those used in taking many of the so-called "spirit" pictures, are necessary to record these rays.

The Handiest Number

Tricks with numbers are almost unlimited but the figure nine, an important digit in many mathematical stunts, is put to practical use in banks and other institutions in finding errors in balances. If the deficit or surplus in a sum is divisible by nine, the chances are that a transposition of numbers has been made. For instance, suppose 69 is put down instead of 96. The deficit, 27, is exactly divisible by nine. If 816 should be written for 168, the surplus, 648, also divisible by the digit "detective," points to the transposition error as the cause of the trouble.

Dirt Pusher Attached to Tractor Saves Shoveling by Hand

To reduce the expense of handling loose dirt and rubbish on city dumps and in making fills, a leveling attachment that may be fitted to the tractor has been invented. It is a wide, flat, hinged blade fastened between two steel beams on each side of the outfit. It is so suspended that when moving in a reverse direction, the blade slides easily over the top of the surface without dragging the dirt back and in going forward, it is held solidly to the supports by strong braces. The entire attachment may be raised clear of the ground when the tractor is moved from place to place and is long enough to allow scraping dirt to the end of a fill without getting the treads into soft soil. It is said to do in a short time, the work of a number of hand shovelers and is also suited to shoving big pieces of junk, such as boilers.

Tractor with Dirt-Pushing Attachment in Place, Ready to Batter Down Piles of Rubbish

Tree Is Made of Pipe for Children to Climb Safely on Playground

Almost all children have an inborn desire to climb but often those in the city cannot find safe and easy natural branches for the exercise. As a substitute for the real thing, and to keep boys and girls from venturing on dangerous places, a tree fashioned of lengths of galvanized pipe with protecting guard rails to prevent injury, has been invented for playgrounds. The crosspieces are spaced at convenient heights and the standards are seven feet high. There are no projections to tear the clothing or cause cuts or scratches, and the pipe is meant to withstand rough usage and the weather for a long period.

On This Sturdy Playground Tree of Pipe Lengths, Children May Climb in Safety

¶ More than half of the world's annual gold output is produced in British South Africa. In 1921, the yield was valued at nearly $170,000,000, fifty-six per cent of the total mined throughout the world.

Front View of Tractor Post-Hole Digger, Showing Ratchet Feed, Gears and Truck Suspension

Auto Truck That Bores Post Holes Saves Linemen Labor

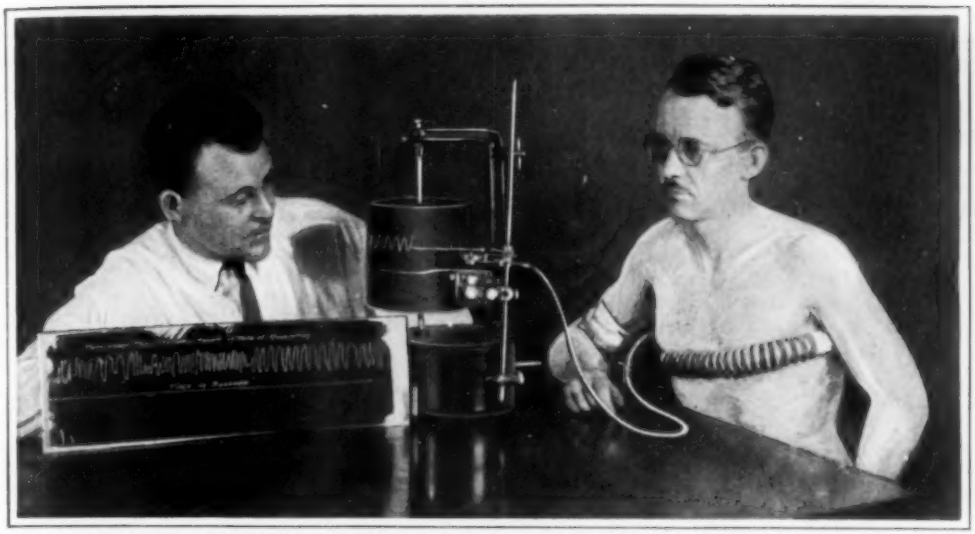
Digging the deep holes required for telephone or telegraph-line poles is simplified by an auger borer attached to special gearing rigged to a powerful automobile truck. Swung to the side of the road over the spot where the pole is to be set, the digger is quickly put into operation by throwing a clutch. A ratchet feed automatically presses the sharp point of the drill into the soil as the blades revolve. Reversing the gears withdraws the auger, and truck and all can be moved quickly to the next position.

Mystery City Built before Babylon Reveals Origin of Writing

Buried in the dust for more than 6,500 years, records of man's progress in art, literature, commerce and government have finally come to light from excavations made by members of the Field museum-Oxford university expedition on the site of Kish, nine miles from Babylon on the banks of an old channel of the Euphrates river. Relics found there are said to be the first tangible evidences of the origin of the Semitic dynasties, and prove that, long before the splendor of Babylon and the high civilization of Egypt, the city was the center of a cultured empire ruled by a non-Semitic race, the Sumerians. One of the most important finds is what is said to be the oldest stylus in the world. Scientists believe that this ancient instrument, a piece of bone about five inches long and as big around as a lead pencil, with the clay tablets also discovered, proves that the Sumerians gave the world the art of writing by originating cuneiform script. The stylus was held in the hand in the same position as a pen of modern days and the characters were inscribed in the soft material by dexterous twists of the implement. A library of tablets, apparently used by the public, was discovered together with large quantities of pottery, copper articles and pearl-inlay work. The crumbled stones reveal architectural skill, and ruins of roads and canals indicate interest in commerce.

Rubber Marker for Tennis Balls Prevents Loss and Disputes

Doubt and disputes that sometimes arise as to the ownership of tennis balls, are avoided by the use of a compact and simple little outfit, consisting of a rubber stamp, a pad and a supply of indelible ink, to mark the balls. The letters produced are sharp and legible, do not easily blur and can be applied at several places on the ball in a fraction of the time required to print them by hand.



Recording the Rate and Volume of Respiration with a Pneumograph, Which Registers the Movement of the Lungs and the Regularity of Breathing as It Occurs under Changing Temperatures

How Heat Affects Your Efficiency

Bureau of Mines' Experiments on Men Fix Limits of Temperature and Humidity beyond Which Human Beings Cannot Exist

THAT you do better work in the spring and autumn and are more prone to make errors in the hot days of summer and the cold weeks of winter, has been scientifically calculated in experiments completed by the bureau of mines.

The deeper mines go toward the center of the earth, the higher the temperatures rise, while the presence of streams of underground water produces high humidity, so the bureau undertook the study of the combination of heat and damp air on the efficiency of the workers.

While designed primarily for the compilation of industrial-efficiency data, the tests disclosed interesting facts about the effect of temperature and humidity changes on any person exposed to the extremes of weather.

In previous investigations Dr. Ellsworth Huntington, of Yale university, using West Point and Annapolis cadets as subjects, determined that the best mental work could be done at thirty-eight degrees, only six points above freezing, and that manual workers were at their best at fifty-nine degrees.

The bureau of mines' experiments, however, showed the approximate limits at which work was at all possible, and disclosed that it is not so much the body temperature as the high pulse rate which causes collapse when heat and humidity get too high.

The tests were carried out in two rooms, lined with four-inch cork walls and equipped with apparatus for cooling, heating, washing, drying, measuring and stirring up the air. Control instruments outside the experimental rooms regulated the temperature and humidity, recorded the body temperature and pulse rate of the subjects, and took samples of the air they exhaled. Miners, stripped to the waist to duplicate actual working conditions, could not exist in comfort, the experiments showed, at temperatures above ninety degrees, with 100-per-cent relative humidity, in still air. When a wind tunnel was added and the hot, moist air blown through the experimental rooms at a velocity of 200 feet a minute, the subjects could endure a temperature of 95 degrees indefinitely and by increasing the wind velocity to 400 feet the cooling effect of the air was still more pronounced.

In most of the experiments the subjects remained in the test rooms for three hours, but in tests with high temperatures they usually collapsed and had to be carried out and revived, otherwise the experiment would have proved fatal.

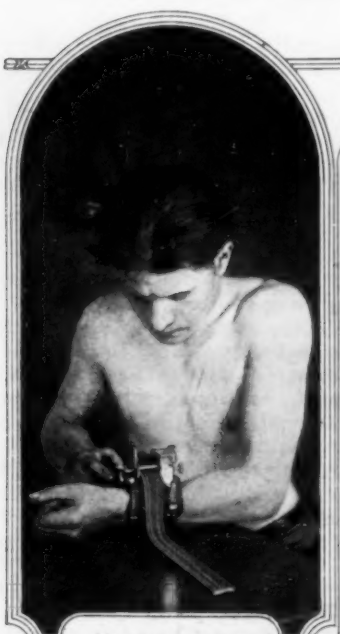
Without exception the men tested all complained of unbearable symptoms when the pulse rate increased, without regard to the temperature. Very uncomfortable sensations were experienced when the pulse passed 135 pulsations per minute, and the condition became unbearable at 160. All of the men tested were weighed before entering the rooms, the scales used being so delicate that they measured quarter ounces, and then weighed again after the tests. It was found that fat men lost more weight than thin men, but that the latter class broke down sooner and could not stand the high temperatures and high humidity through which fat men lived without great discomfort.

After the experiments, the subjects drank large quantities of ice water without any ill effect, dispelling the old belief that ice water would cause cramps if taken when one is overheated.

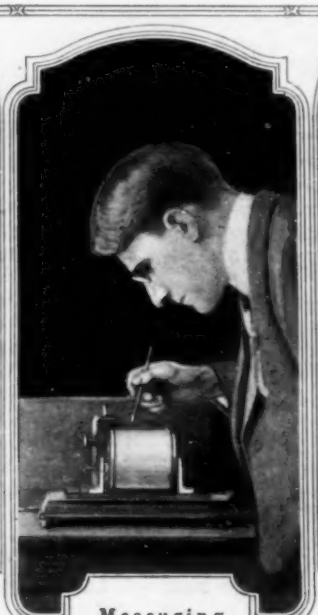
The effect of the change in temperature on the subjects was watched through glass windows in the sides of the experimental rooms. Frequently men who entered the chambers in happy, joking mood soon became restless and irritable. They experienced headaches, palpitation of the heart, great thirst and inflamed eyes as heat and humidity increased. Dizziness followed, speaking became difficult and a "dragged out" feeling ensued. Perspiration trickling into the eyes was found to be responsible for the inflammation.

Throughout the tests electric thermometers were applied to the mouth, chest and back of the men, recording the body temperatures in the control cabinet outside. At intervals, unknown to the subjects, the respiration rate was taken by means of an inflated tube strapped around the chest and connected to a recording instrument in the control room. Samples of the expired air from the lungs were collected in an oxygen-breathing apparatus, passing through tubing to a gasometer, while a nose clip prevented nasal breathing.

The scientists in charge of the experiments decided that no human being could possibly exist in a saturated temperature of 135 degrees for any material length of time, while moving air at ninety-eight degrees can be endured in comparative comfort for about three hours. Another interesting discovery was that it was possible for the subjects to hold their breath longer in hot air than in cool. Plans are being considered for duplicating the tests at very low temperatures.



Taking Automatic Record of Pulse Beats Which Is Shown on Smoked Drum

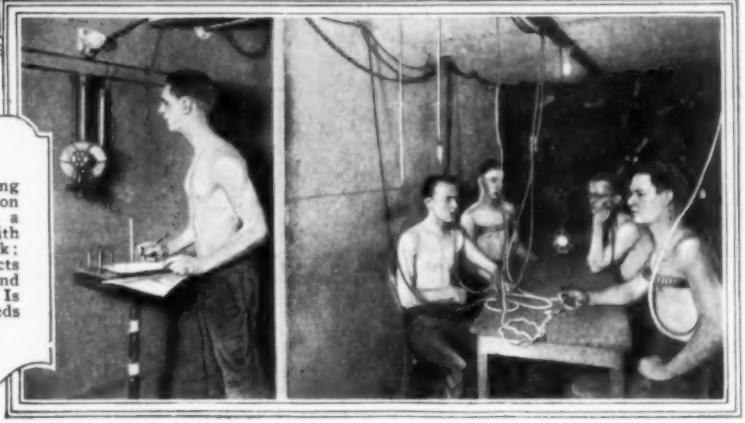


Measuring Rain Weight to Determine Volume of Moisture in Air

Registering Temperatures of the Body to Show Effect of Atmospheric Changes

Taking Readings of Blood Temperature to Learn Cooling Power of Air

Apparatus Designed to Trace Blood Pressures



Above, Experts Studying Effect of Temperature on the Human Body, in a Sealed Room Lined with Cork Four Inches Thick; Right, Group of Subjects under Heat Tests in Wind Tunnel Where Air Is Moved at Various Speeds by Series of Fans

Big Gun on Partly Submerged Sub Protected from Bow Wave

A four-inch gun on the conning tower of the British submarine boat "L-23" can be fired while the craft is partly submerged. The armor-steel turret, shaped like a ship's hull, is designed to cut the bow wave, protecting the gunners from flying spray and the wash of the sea when the boat is traveling at high speed. Signaling devices for the direction of the firing crew are controlled from an inclosed chamber where targets are located and ranges determined. Due to the rifle's long range and its ability to operate when the sub is partly concealed, the craft is claimed to be a formidable weapon for naval warfare.

Rifle Turret of Submarine Shaped to Protect Gunners from Wash of the Sea When Craft Is Traveling Partly Submerged

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Products of the forty-five chewing-gum factories in the United States are valued at $48,524,499 a year, according to figures of the department of commerce.

Automatic Elevators Save Time for Skyscraper's Traffic

Elevators that start, stop, and open and close doors without aid from operators have been installed as timesavers in a New York skyscraper. As a car is taking on its passengers, the attendant registers the stops by pressing buttons that correspond to the desired floors. A movement of a small lever starts the lift on its upward journey and at the same time automatically controlled gates are closed. As the elevator reaches a floor previously indicated as a stop, the car halts and the doors are whisked back and closed again by electrical interlocks when the passenger has stepped out. Persons awaiting a lift on one of the upper floors need only push a signal at the shaft to cause either a descending or ascending car to stop at that point. The elevators are equipped with self-adjusting devices which eliminate the necessity for "inching" up or down when leveling the car at a floor. Although the elevators are capable of traveling 1,100 feet a minute, they start and slow down gradually in order not to affect the comfort of the occupants. With their use it is estimated several minutes are saved on each round trip by the absence of false stops, leveling, and opening and closing doors by hand.

Trees as Aerials Relay Messages Distance of Three Miles

Forest rangers in Washington have discovered that with the simple addition of a copper nail, the branches of firs and hemlocks can be made to serve as radio aerials. Tired of carrying wire, they drove a nail at the base of the tree trunk, and connected it to the sender. Messages were received successfully two and three miles away, according to reports.

Derelict's Wanderings Aid Charting of the Ocean's Currents

Floating unguided on the Atlantic ocean for more than a year, the wreck of the lumber schooner "Governor Parr," abandoned by its crew in October, 1923, during a storm, has been used as an aid in charting the speed and direction of flow of the sea currents. Traveling thousands of miles since it was left to "run wild" on the sea, the ship has been constantly reported from widely separated points along the steamer lanes. By checking up this information, marine authorities are able to correct their charts. Several attempts to salvage or destroy the wreck have failed. Once taken in tow by a coast-guard cutter, the derelict had to be cast loose during a gale. Months later it was sighted off the coast of Portugal, and although set afire in the hope it would sink, the damaged vessel was seen again hundreds of miles from that place.

Sidecar Rider Risks Life on Curve to Win Motorcycle Race

While credit for most motorcycle racing records is due to the drivers, sometimes their helpers and mechanics deserve no little praise. This was true in a race in Ireland not long ago. The machines were equipped with sidecars and each carried a passenger. To help preserve the balance in rounding a curve at a high rate of speed, the occupant of one of the cars leaned far outward, hanging to the side of the seat and dash. As the racer roared by, the passenger's head barely missed striking a flag post that had been stuck in the ground to mark the course of the track.

Risking Death to Prevent a Spill, Sidecar Rider Narrowly Misses Flag Post at Sharp Curve of Course

Collection of Ancient Chinese Art Relics That Show Skill of Old Oriental Craftsmen

Ancient Bride's Chair Is Tribute to Lost Arts of China

In a collection of 2,500 Chinese art relics gathered for the Field Museum of Natural History, are pieces of delicately carved jade, bone and wood, remnants of a craft that is said to have become extinct. The ornaments are believed to be more valuable than precious stones. Among the exhibits is to be seen a chair in which the oriental bride was carried to the house of her prospective husband. It is built of wood, decorated by beautifully cut figures, and lacquered in red. Some of the articles were made almost fifty centuries ago and are well preserved. Many household utensils and artistically designed pottery, examples of ancient oriental handicraft, are included in the display.

¶About 15,000 bakers are needed to supply New Yorkers with their daily bread.

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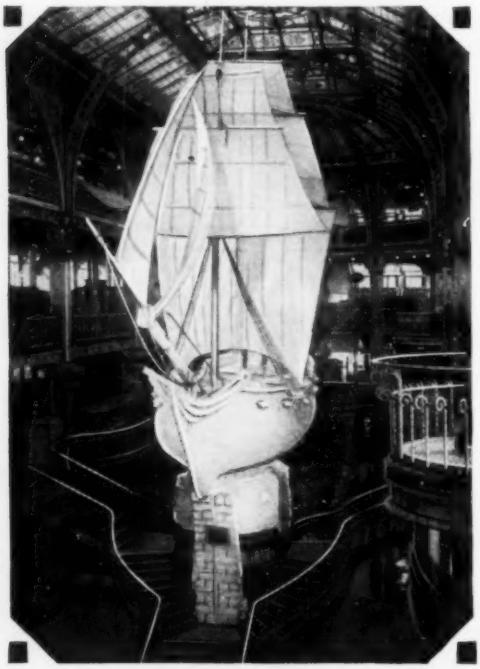
Vessel Is Built of Bargain Goods to Herald Sale in Paris

To advertise an annual sale of white goods, a Paris store displayed a model of a sailing bark made from articles offered



Towel-and-Sheet Sailing Ship Rigged in Store to Advertise White Goods Sale

at the bargain counters. Closely matted piles of towels form the supports for the vessel and the hull is constructed of the same materials. Sails are rigged of muslin sheets, and spars and masts are wrapped in white.

Treasure Hunters Find Rich Booty on City Garbage Dumps

The Detroit disposal plant yields for its official prospectors better returns than the average mining claim. The carelessness of people in throwing away their possessions is a constant source of wonder to the inspectors. The largest hauls are in silverware. Recently the manager notified two hotels that he had most of their silverware, and when they sent representatives to the plant he delivered several large gunny sacks filled with monogrammed table silver and a three-foot coffee urn, all recovered from the refuse. Several waiters thereupon lost their jobs. Valuable discoveries are advertised in the papers, but no owner has been found for an antique solid-gold ring weighing two ounces. A complete golf set, clubs and half a dozen balls, occupies a post of honor in the disposal-plant museum of recoveries. Near by is a hypodermic needle, a complete opium-smoking outfit, a line of silver cigaret cases, cigar cutters and briar pipes, a beautiful gold-incrusted stiletto, a dozen razors, many watches, and heaps of finger and ear rings.

The Toll of London Fogs

According to one authority, a single London fog may cost more lives than a pitched battle. The period of the greatest prevalence of the dense mists is in December, with the other winter months not far behind. At this season of the year, the death rate from lung diseases reaches its height. The heavy, moisture-laden air aggravates such maladies, the lack of sunlight reduces physical resistance and illness frequently results from chills caused by the dampness. Mental depression is considered another harmful effect.

Ventilating Eaves for Closed Cars Clean Air without Drafts

Formation of steam on the inside of closed car windows in cold weather, or sticking of rain drops and snow to the outer side in the driver's line of vision is prevented, the manufacturers claim, by a newly patented ventilating eave. The suction set up by the device is also said to instantly remove motor gases, smoke and

Closed Car Fitted with Ventilating Eaves Extending from Top like a Canopy

foul air from the car, while in cold weather the circulation helps the operation of the car heater without causing disagreeable cross currents. The degree of ventilation can be regulated by raising or lowering the window.

Gathering Eggs on a Hen Ranch in California Where the Layers Produce Material with Which the Electric Incubators Work; All Eggs Are Handled Gently to Prevent Injury

Electric Hens Hatch Billion Chicks

Eggs Produced on Hundreds of Big Poultry Ranches Are Nursed into Flocks of Fluffy Youngsters by Machines

THE sitting hen which for twenty days or thereabout covers a hatch of rarely more than a dozen eggs until ten or eleven of them appear as lively fluffy balls of down may soon have its place entirely taken by the "electric hen" designed to care for 575,000 eggs at a time, hatching 25,000 a day with a total capacity of 3,000,000 chicks a season. One of such hatcheries, and among the largest in the world, is located at Peluma, Calif., where it takes constantly the egg output of thirty large poultry farms. With 1,260 built-in electric incubators, automatically operated and controlled, and all under one roof, this machine turns out more chickens than all the hatching hens and portable incubators of the neighboring valley combined formerly produced.

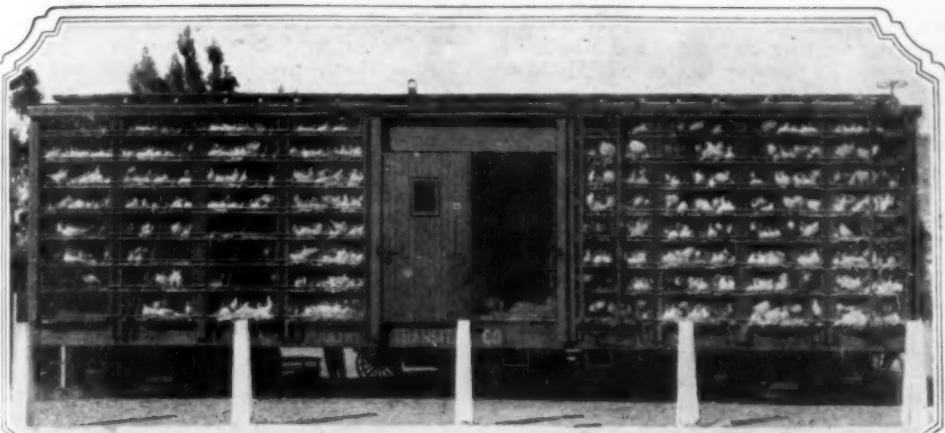
The only eggs accepted for the plant are those from hens which run at will in big flocks over large ranches. Eggs intended for food are produced by hens kept in small coops and pens. These are fed special grains and are stimulated by electric lighting. But it is the eggs of the free-range hen that produce the largest, strongest and longest-lived chickens, which also turn out to be the most productive fowls when they grow up. All eggs gathered from the roving flocks are first weighed and graded according to size and color. They must not weigh over twenty-six ounces nor less than twenty-two ounces to the dozen, and the shell texture, shape and shade must be uniform.

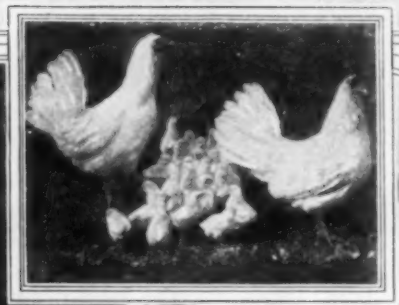
Arriving at the incubating plant, they are candled and tested by electric searchlights which equal X-rays so far as these eggs are concerned. This preliminary treatment insures the quality and uniformity of the chicks by eliminating infertile and otherwise worthless eggs. Then thirty tons of these white ovals are gently placed in trays and slipped into the incubators, where approximately 750,000

Part of a Brood of 100,000 Chicks Just Out of the Electric Incubator and Strong Enough to Climb from Their Trays and Run About, Due to the Uniformity of Temperature Control Maintained by the Machine

Transferring the Baby Chickens from an Electric "Hen" That Holds 2,400 Eggs; Youngsters Can Be Removed without Disturbing Other Hatches

Packing Eggs for Shipment to the Incubator Plant; Care Is Taken That Only Those of Proper Size, Shape, Color and Shell Texture Are Selected; Right, Sectional View of Mammoth Hatching Machine Showing Egg Racks, Chick Trays, and Apparatus for Heating and Ventilating Systems





To Guard against Inbreeding and to Insure Vigorous Chicks, Carloads of Breeding Cockerels Are Shipped to the Egg Farms Every Year Where Producing Hens Run Free on the Ranges. Below, a Grader Preparing Baby Stock for Shipment; No Food Is Included as the Little Chickens Have Enough Nourishment for About Two Days When They Issue from the Shells; Insert Shows a Pair of Mother Hens with Their Broods

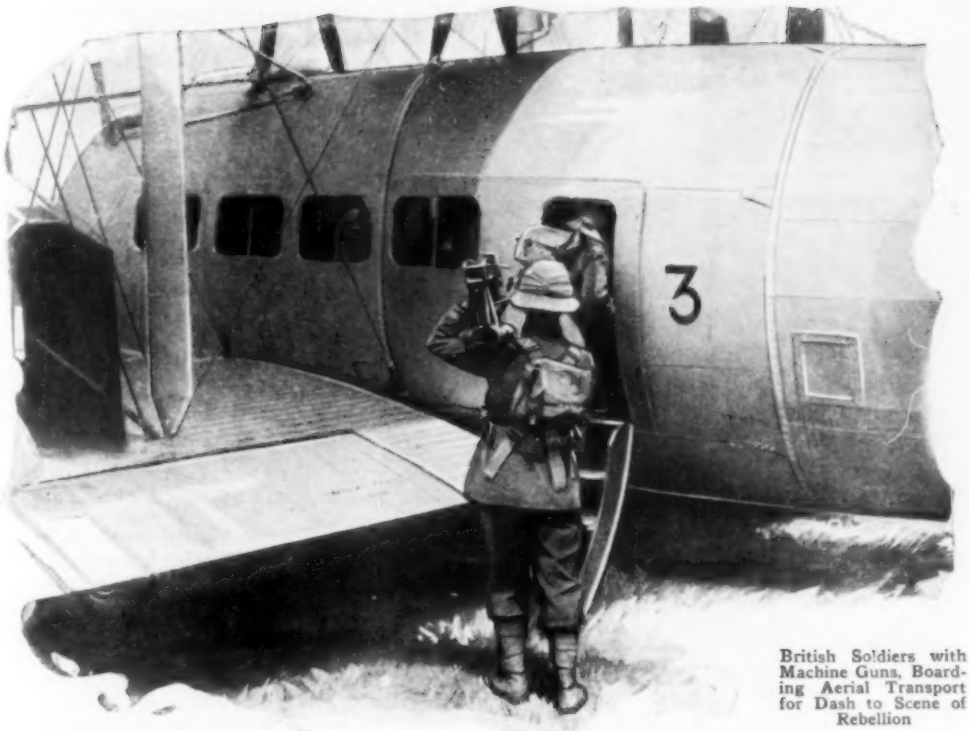
feet of resistance wiring has been used to form the heating element. Each rack has an automatic turning device which slowly rolls over 100,000 eggs in ten minutes without breakage. All hatches are turned six times in twenty-four hours. On the fifth and thirteenth days after they are set, electric spotlights are employed to test the eggs for fertility and to determine if any show indications of injury.

When the chicks are hatched, they are kept warm by electrical heaters and as soon as they can run about, the "peeps" are packed into corrugated crates for shipment to markets at practically all points west of the Rocky Mountains. Water and food are denied them in transit, for to give them either during the first day or two of their life would prove fatal to the downy youngsters, which retain enough nourishment from the eggs to sustain life and insure development over that period.

Although the science of incubating eggs by artificial methods is as old as poultry keeping, it is only during the past few years that giant machines have been perfected to do the work of thousands of hens. Historical records show that the early Egyptians hatched as many as 100,000,000 chickens a year by artificial means, but theirs was a crude process not always reliable. It is claimed for the incubating machines that they are directly responsible for the poultry industry now returning over a billion dollars a year to the wealth of this nation. Under restrictions of the sitting hen, production could not well keep pace with consumption, but now more than 700,000,000 eggs are hatched annually by mechanical methods, while about 300,000,000 are mothered by farm hens. The total value of this "crop" of chicks is estimated at more than $200,000,000. The machines have almost entirely relieved hens of the hatching in parts of the country where poultry raising is most general. Farmers and poultry raisers have learned that it is far more economical to purchase baby chicks from the big breeding plants than to have them hatched out on the nests. Where hatches were numbered in a few hundred eggs by the old methods, the big incubators turn them out by the hundred thousands in the same space of time. And the machine chick is almost invariably a better fowl.

The most vital element in artificial incubation is temperature control, for even the slightest variation in the state of the surrounding air during the hatching period might result in a decrease of chicks or cause weaklings and crippled fowls. For the purpose of maintaining proper warmth at all times, devices are installed in the machines to regulate the temperature of the water in the heaters and the flow through the pipes on the inside of the incubators.

Hundreds of Thousands of Eggs Awaiting Deposit in the Hatching Chambers of the Big Electric Incubator at Peluma; 750,000 Feet of Wire Was Used in the Heating System



British Soldiers with Machine Guns, Boarding Aerial Transport for Dash to Scene of Rebellion

Airplane Transports Help Soldiers End Rebellion Quickly

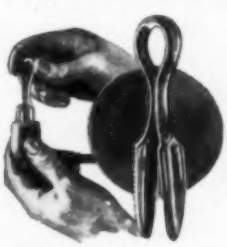
Transporting troops by airplane is an accomplished fact in Great Britain. Huge machines that can carry twenty-two men and two pilots, besides guns and quantities of ammunition, are now part of the army and already have been used for practical purposes. Their effectiveness was illustrated not long ago when a native rebellion occurred in Mesopotamia. A squadron of aerial transports was loaded with troops at a distant post, sped to the scene, and in less than half an hour the uprising had been stopped.

Whale-Canning Industry Now Links Distant Points of Empire

British Columbia has become linked to west Africa by an industry which has sprung up recently, the whale-canning trade. In the waters off the northwest coast of North America are large numbers of the finback species of whale, but catching them for their oil proved only moderately profitable and the meat was never saved. Lately, however, the flesh is tinned and shipped to African colonies, where the natives are said to consume it greedily. Reports state that they have found it a cheap and palatable addition to their fare, which consists mainly of a puttylike paste done up in leaves and which only native west Africans are said to be able to digest.

Pipe-Bowl Scraper Removes "Cake" without Injury to Wood

For quickly removing the "cake" from the pipe bowl, a self-adjusting spring-steel scraper that will not injure the wood has been invented. It is made of a single piece of metal with two spoon-shaped jaws that will slip inside the bowl and are turned by twisting a handle. One of the blades has sawlike teeth for scratching off the carbon, and both are so shaped that they cannot cut the bowl as sometimes occurs when a knife is used for this purpose. The scraper fits large and small pipes and a twist or two suffices to give the bowl a thorough cleaning.



How Extension Ladder Works on Sloping Roof, and Close View of Attachment

Extension Leg for Ladder Prevents Falls on Sloping Surfaces

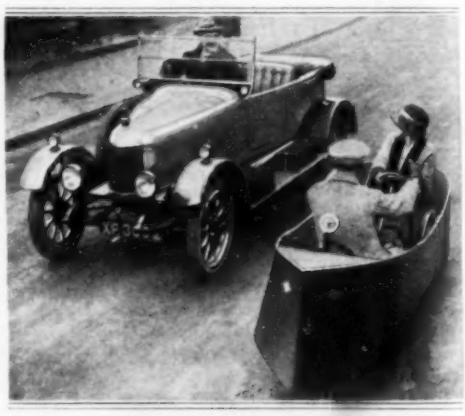
To prevent accidents when ladders are used on sloping roofs or other uneven surfaces, a metal extension that can be applied to either leg of the ladder in a few seconds has been designed. It is firmly held at any desired point by strong setscrews and rests on an angular end that firmly grips the surface without cutting or denting it. It can be adjusted to any length between one and fifteen inches. It does not damage the ladder, as would a temporary extension nailed to the leg, and is considered much safer than blocks.

Higher Voltages Are Made Possible by Better Insulation

Recent improvement in insulators has brought currents of 330,000 volts' pressure within the realms of possibility, according to the Engineering Foundation, which has issued reports on the most recent discoveries in handling high-tension electricity. Currents of 220,000 volts are now being used in actual practice, and the same insulators, when dry, will keep 280,000 volts on the line. At one time, about the year 1900, electrical engineers believed 60,000 volts was the absolute limit in current which could be handled. Since then new discoveries and gradual modification and improvement of insulators have increased the working limit more than 400 per cent until now transmissions of 330,000 volts' pressure or more are a practical possibility. The problem in long-distance transmission of electricity has been to obtain pole insulators which would protect the high voltages necessary to make economical transmission possible. Electricity has a tendency to jump off the wire and seek an easier path to the ground. The result is a "corona," or faintly visible leakage, or else an "arc" in which the high-pressure current leaps across the insulator as a spark clears a gap.

Tandem Road Boat Is Propelled by Pulling on Levers

Propelled by two hand levers attached to gears on the wheels, a tandem road boat has made its appearance on an English highway. While one occupant furnishes the motive power by pulling on the levers, his companion sitting opposite him, manages the steering wheel. A fair rate of speed is possible with this contrivance, and it is operated easily on smooth roads.



"Rowing" a Road Boat along Automobile Highway; Steering Is Done by Person in Rear Seat

Rubber tires and flexible springs found in regulation motor cars make the boat a comfortable conveyance.

¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished by addressing the Bureau.

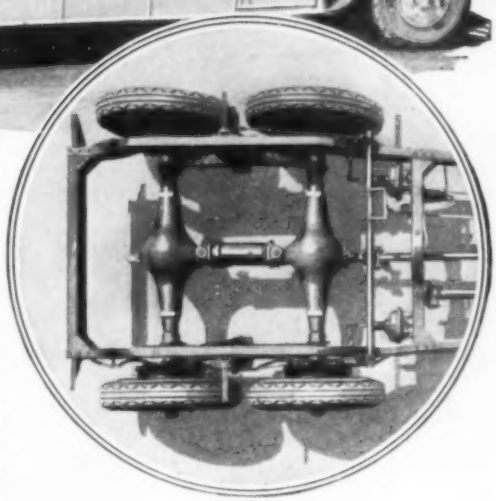
Exterior of Six-Wheeled Motor Bus and View Looking Down upon Rear Trucks

Six-Wheel, Double-Deck Motor Bus Gives Greater Comfort

Double-deck busses that run on six pneumatic-tired wheels have made their appearance in a Pacific coast city. They are said to be more comfortable than those with solid tires, safer and more economical. The greater ease possible with pneumatic tires has not been enjoyed in double-deck busses with the ordinary wheel arrangement to any extent, as the load has been considered too great with an attendant danger of punctures and blow-outs. The bus has four driving wheels and all six are equipped with brakes. A six-cylinder motor furnishes the power.

Fish That Sing Found in Ceylon

Shellfish that produce a low flutelike sound after they have been left for some time on the rocky beach at low tides are reported from Ceylon. As the bivalves have no throat or vocal organs, it is probable that the sound is made by manipulation of the double shell, and increasing dryness is thought to have a part in the phenomenon for the noise is heard only after the fish have been stranded several hours. Scotch fishermen know a species, called the "butterman," which produces a hooting sound when landed, and the gurnard, a fish found off the shores of England, makes a croaking noise like a crow.



Power and Mileage Are Increased by Auto Valve Levers

Designed to provide more power and generally improve the performance of Ford motors, an easily installed lever mechanism has been manufactured to increase the lift of the valves. Greater mileage, saving of gasoline and less wear on the engine are claimed for the device and no alterations are required to install it. With the outfit, a needle-valve control for the carburetor, to give a richer mixture for starting and a gradual decrease of flow as the motor warms up, is provided.

One-Piece Trouser Press Removes Baggy Knees and Creases Cuff

Trousers are quickly creased and pressed and the bag taken out of the knees in a

Smoothing Trousers Before Webbing Strips at Right Are Clamped across to Other Side

stretcher now being manufactured in England. It has no top piece to be unscrewed or adjusted and consists simply of a convex board with two wide strips of webbing attached to a roller at one end. The trousers are laid flat on the board, the webbing is extended and fastened to a clamp at the other end and bound forcibly against the cloth. The curve causes the maximum amount of stretch to occur at the knees. The pressure can be regulated by adjusting the clamp or taking up the slack in the strips.

Aeroplane Oil Made from Locusts

Science has found a use for the locust, one of the greatest crop destroyers in the insect world, since a way has been discovered to extract an excellent oil for aeroplane engines from them. It is said to have special properties which suit it for that purpose and it retains its liquidity at high altitudes. Locusts are now being exported from Africa to Holland, one recent shipment consisting of eighty-eight bales weighing nearly eighteen tons.

Single-Wheeled Sulky for Racing to Prevent Accidents

To prevent accidents that sometimes occur during light harness races, a well-known driver has designed a one-wheel sulky. It is expected to eliminate the possibility of vehicles becoming locked together on the turns or the straightaway, and make it impossible for the horse to put a foot through the spokes. The driver sits about ten inches farther back from the horse than he does in the present style, and instead of the high stirrups for his feet, there are strong supports so placed that he sits in an upright position. The wheel is directly under the seat.

Washing Big Clock's Hands and Face Requires Skill of Steeplejacks

Nimble steeplejacks who think nothing of risking their lives on high buildings and in precarious positions, were required recently to clean the soot and dirt from the face of "Big Ben," the famous clock on the tower of the British house of parliament, 300 feet above the ground. Several days were consumed in the task, and the workers were compelled to exercise care not to damage the mechanism of the giant timepiece or the lettering on the dials.

Steeplejacks High above the Bustle of London's Streets Brightening "Big Ben's" Face

Worker Queen Drone

Nature's Cleverest Mechanic—the Bee

Uncle Sam Working to Solve the Perplexing Mysteries of the Modern Beehive for the Benefit of Mankind

IF a great international prize were to be awarded to the most efficient factory and workshop in all creation, practically all the other competitors would be distanced by the modern beehive.

In the field of modern invention, in the realm of practical science, in the annals of bustling industry, there is no individual agency eclipsing a bee colony in efficiency. The diminutive bee is the boss architect among insects, the champion contractor, the most resourceful workman, the most industrious laborer.

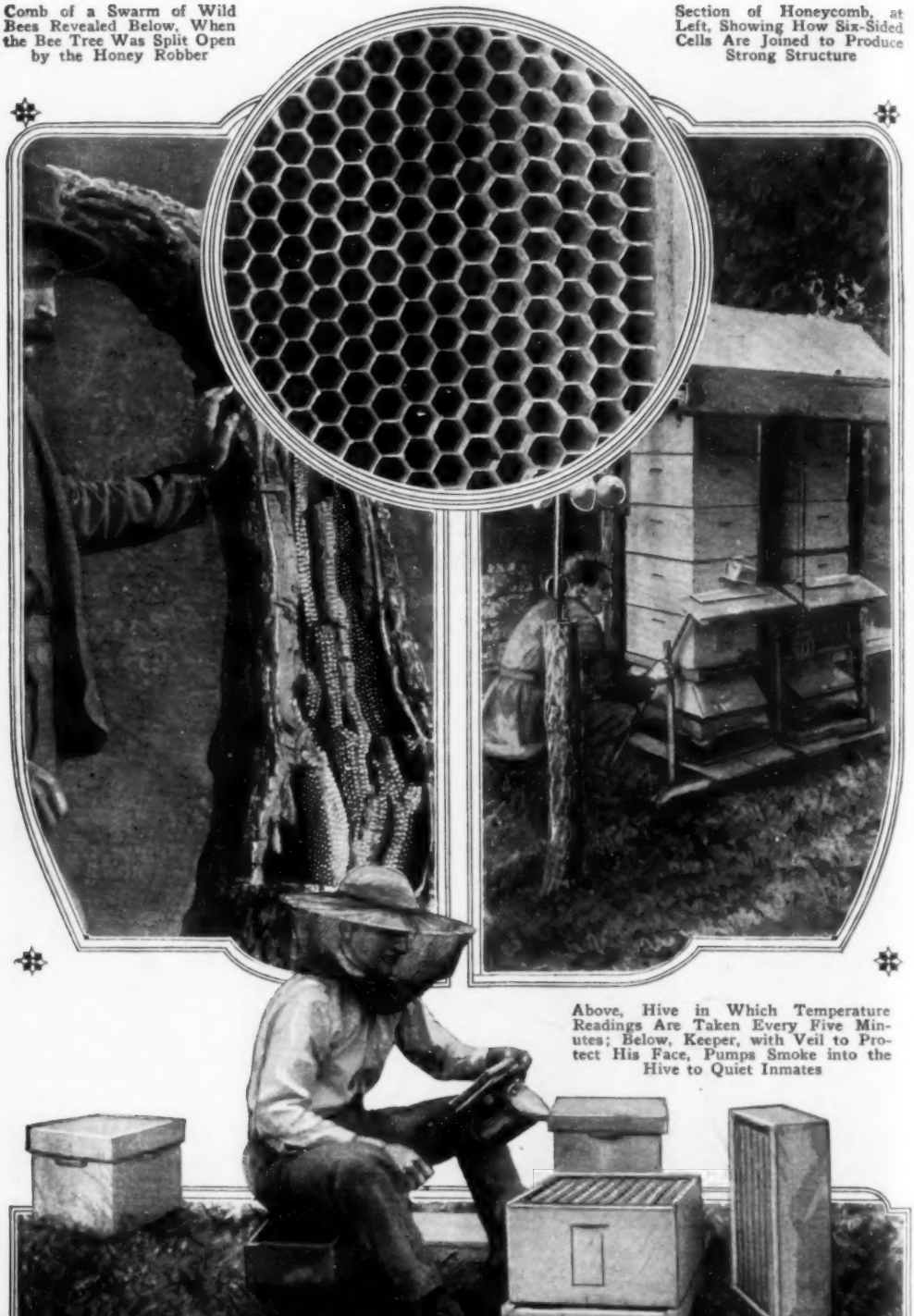
The scientific facts already gathered and verified by the department of agriculture, qualify the bee as the world's master mechanic. The bees build a fine home. They equip it with heating and ventilating systems. They stock it with food. They perfect an industrial and business organization. Provision is made for the removal of all debris. Neither waste motion nor lost energy complicate activities. Distribution of labor is equable.

These Bees, When They Swarmed, Picked a Fence Post as a Convenient Resting Place

Uncle Sam's scientists have discovered that the ordinary honey bee is an expert on temperature. You or I can only guess how cold or warm it is. The bee knows exactly when the temperature reaches fifty-seven degrees Fahrenheit. It is the danger temperature for the bustling "buzzers." When the mercury drops to that point they know intuitively that it is time to huddle together and build an imitation bonfire. Without the use of matches, tinder or firewood, they produce heat which keeps them from freezing to death. There is no furnace system in the history of engineering more remarkable than the bee heating plant which runs without fuel. When the temperature of the air immediately surrounding the bees falls to fifty-seven degrees or lower, 15,000 to 20,000 bees will form a cluster. The

Comb of a Swarm of Wild Bees Revealed Below, When the Bee Tree Was Split Open by the Honey Robber

Section of Honeycomb, at Left, Showing How Six-Sided Cells Are Joined to Produce Strong Structure



Above, Hive in Which Temperature Readings Are Taken Every Five Minutes; Below, Keeper, with Veil to Protect His Face, Pumps Smoke into the Hive to Quiet Inmates

bees in the center of the mass by muscular activity then generate heat. Those on the outer portion of the cluster serve as insulators by crowding close together, usually with their heads toward the center of the cluster. The number of bees that function as stoves depends on the outer temperature. The colder it becomes, the greater the number of these extraordinary furnace men. The entire cluster by contraction becomes smaller as the external temperature falls. By their physical labors, the worker bees produce heat to the extent that the core of the cluster often may attain a temperature of ninety degrees or higher. The insulation of the border of the cluster is so perfect that heat can escape only very slowly.

If Handled Rightly, Bees Make Gentle Playmates for Classes of Eager Young Girl Students

Although the coal bill for the average bee mansion is nil for the winter season, the beehive has to pay for the heat which its inmates develop when the temperature drops to fifty-seven degrees or lower. Honey is their food. The buzzing bees expend large amounts of energy in their muscular contortions which heat the cluster. This expenditure of energy really shortens their lives and the furnace burns out. Literally, they constitute one class of laborers that work themselves to death. The national scientists have ascertained that honey bees are quite like small dry batteries in so far as their vital energy is concerned. They emerge into life as adult bees with a certain amount of vital energy. When this is exhausted they die. Unlike human beings, these honey-making insects do not have the power to regain lost vitality. Commercial beekeepers strive to maintain their bee colonies under such winter conditions that the temperature will not fall below the danger point. Thus the bees are able to conserve their energy. They do not have to waste this valuable resource in heat generation.

Queer to tell, the same industrious bees that provide the heat for the unprotected colony during the winter also work as ventilation experts during the summer. Science has determined that the buzz of the beehive is not the echo of industry but the hum of an extraordinary method of ventilation. Squads of worker bees are stationed here and there and everywhere throughout the hive. In regular cadence, these insects flap their wings in order to introduce and circulate pure air throughout the honey workshop. Simultaneously, these bees working as substitute electric fans, force the foul air from the factory. The government bee farm, the largest research establishment of its character in the world, is located in a Washington suburb and consists of sixty-five colonies of Italian bees. The total bee population of this remarkable research

Left, Honey Tanks and Extractors, Turned Out in Large Quantities by Factories, Make Bottled Honey Possible; Below, a Steam-Heated Knife, Connected by Tubing to Boiler on the Stove, Slices Beeswax Caps off Honey Frames Before They Go into the Revolving Extractor

Expert Bee Men Scorn to Wear Gloves and Veils When Handling Eighty Thousand Inmates of a Hive, Proving Experience Renders Safety Measures Unnecessary

station during the summer aggregates approximately 4,750,000 workers. A corps of fifteen scientists devote their working hours to the study of bees. There are altogether 800,000 beekeepers in the United States, who maintain about 8,000,000 colonies of honey bees and depend on Uncle Sam's national bee farm for assistance. The experimental project is the testing and proving grounds of the apiary industry in America. During the summer season of rush work, the average bee lives only about six weeks. During the winter, a worker bee often reaches the age of six months if properly cared for. As a consequence of many experimental weighings of worker bees on delicate scales, the national apiarists report the average weight of one of these laborers at seventy-five milligrams. The honey bee, although small, is an Ajax of the insect world for it can fly long distances carrying two-thirds of its weight in honey. When the bee sleeps, it rests with open eyes, for this insect has no eyelids. A honey bee can sting but once, for its stinger remains in the wound and the bee dies immediately.

Wearing a Hat Full of Bees While Delivering a Lecture on Their Habits, Is One of the Stunts of a Famous Bee Man

Bees are bought and sold by the pound, like any less volatile commodity. A pound of good Italian bees is now worth about two dollars, and from two to three pounds of them, with a queen, costing anywhere from fifty cents to fifty dollars, are sufficient to start a colony. It takes about 5,000 bees to make a pound. In preparing them for sale, the bees are poured through a funnel onto the scales and bundled around with no more care than a storekeeper would bestow on sugar or coffee.

An average colony may produce as much as 500 pounds of honey in one season. At the height of the flower period, the hive is robbed as often as every five to eight days, new combs being substituted, or the old uncapped, emptied by the centrifugal extractor, and restored. From 200 to 300-per-cent profit from a hive is not unusual. For example, a man who invested fourteen dollars in a queen, colony, hive and other equipment, took fifty dollars' worth of honey the first year, while his bees swarmed once, so he had two hives to start the next season. Left to themselves to build a home, the bees will work a curtain by hanging one from the other and begin producing beeswax and molding it into a comb. The honey bees usually make a double comb, the base being a sheet of wax, from either side of which tiny six-sided cells are raised, to be used as brood cells for the queen bee's eggs, or as storage cells for honey.

Every cell is a mathematically perfect hexagonal prism, which, mathematicians have since demonstrated, gives the maximum space with the least expenditure of wax. In man-made hives and equipment, the natural habits of the bee are assisted by providing beeswax foundation sheets, with the base of each cell impressed in it. The artificial foundation is exactly like that the bees otherwise would make, but by its use they are saved the time and enormous consumption of honey-making nectar otherwise used up to make wax.

The head of the hive is supposed to be the queen, though bee men now doubt whether she rules or is ruled. The rest of the colony consists of worker bees, which are undeveloped females, and drones, or males. There is usually but one queen in a hive, though occasionally a reigning monarch will permit her old mother to remain in some secluded corner, while killing off her sisters.

The worker bee has two stomachs, a "public stomach" to carry the nectar to the hive, and back of that a "private stomach" into which its own food supply passes for digestion. Queen bees and workers are produced from the same eggs, and the hive can produce queens at will by changing the food on which the tiny larvæ are fed.

The drones have no stingers, and are helpless to defend themselves. No worker bee will ever attack a queen, but as soon as the first queen is hatched, she attacks all other queen cells and kills her unborn sisters, and likewise will fight any invading queen, while her subjects stand around in circles to watch.

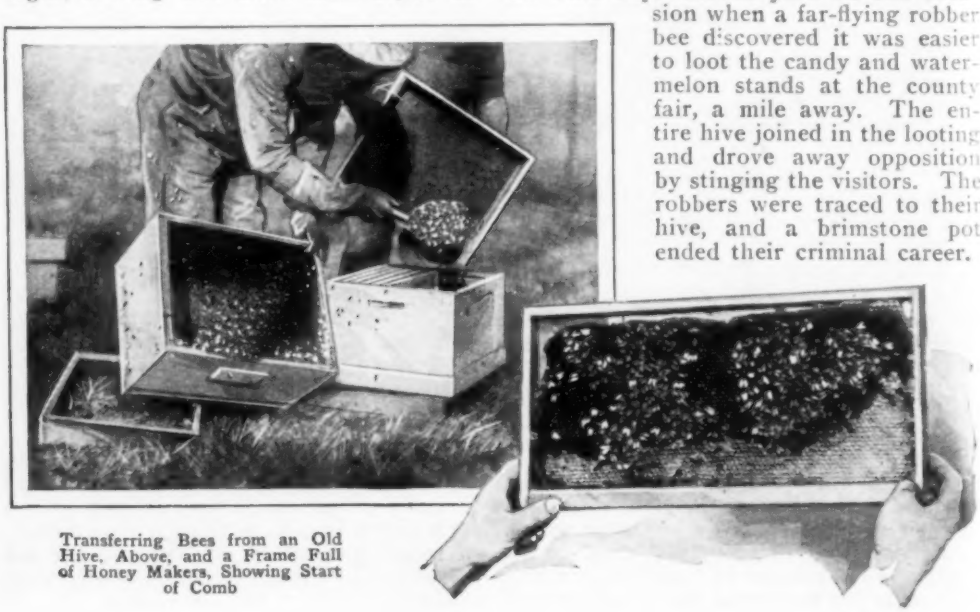
If it becomes necessary to kill an old queen or a usurper, the worker bees "ball up" around her, forming a living ball of bees, with the victim in the center, to smother or starve to death. In that way the guilt of queen-killing is divided among the entire colony.

One of the unfathomed mysteries of the bee is the practice of swarming to found new colonies. A strong hive, happy and prosperous, with storage cells overflowing with honey and an easy life in prospect, will suddenly divide, and the old queen will lead most of the inhabitants away to found a new colony, where they must struggle in poverty and risk death itself to build up a new city. From a colony of 100,000 bees, as many as 80,000 will suddenly elect to follow the old queen in her flight, leaving not more than 20,000 to feed and nurse the unborn queens, drones and workers they leave behind. The bees actually "make honey," since the nectar gathered from flowers must be entirely changed, chemically, to become honey. As gathered it is the same as cane sugar, but when modified into true honey it becomes what is known as invert sugar, composed of levulose and dextrose, with small parts of iron, lime, sodium, sulphur, magnesia and phosphoric acid. It is these elements which make honey a desirable food.

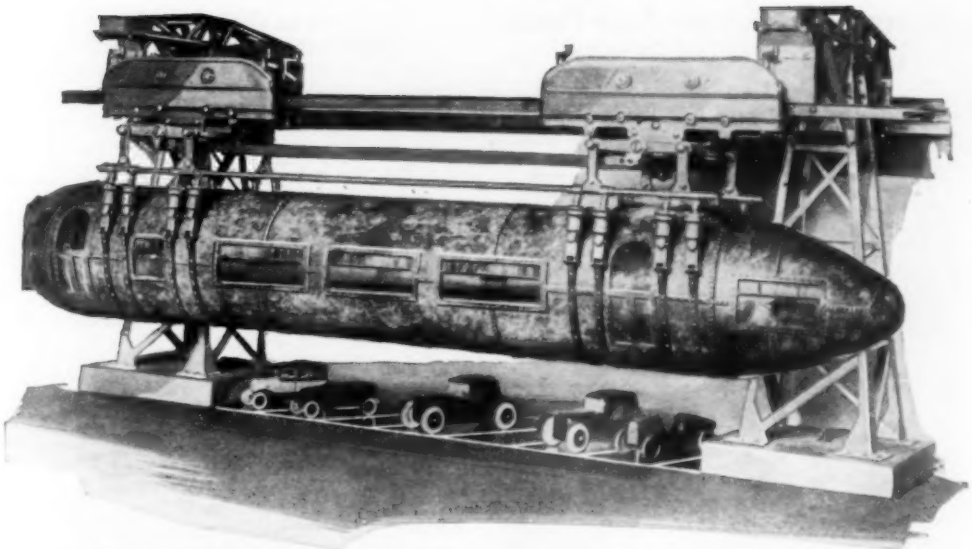
The nectar is modified into honey by heat and air. Thousands of bees remain in the hive gently fanning their wings to keep the air circulation going. The fanning is so well organized that a perceptible current is created. A lighted match held at an opening on one side of the hive will have the flame sucked in, and on the other side the fire will be repelled.

The bees have many human traits, and occasionally become thieves. When a bee finds it is easier to steal from a neighbor's hive, getting pure honey, instead of making the long trip to the fields to bring back the much weaker nectar, it immediately returns home and communicates the news to all its friends.

When bees "go wrong" capital punishment is about the only remedy. A "robber trap" placed on the hive lets the thieves in, but keeps them from going out again, and when all have been trapped, justice is inflicted by smoking them to death with brimstone. Trouble arose at an Ohio experimental yard on one occasion when a far-flying robber bee discovered it was easier to loot the candy and watermelon stands at the county fair, a mile away. The entire hive joined in the looting and drove away opposition by stinging the visitors. The robbers were traced to their hive, and a brimstone pot ended their criminal career.



Transferring Bees from an Old Hive, Above, and a Frame Full of Honey Makers, Showing Start of Comb



Model of Torpedo Car, a Rapid-Transit Coach Which Is Operated in Twin Arrangement Suspended like a Packsaddle across a Single Elevated Rail over Which It Speeds

Torpedo Cars Hung from Single Rail May Speed Future Traffic

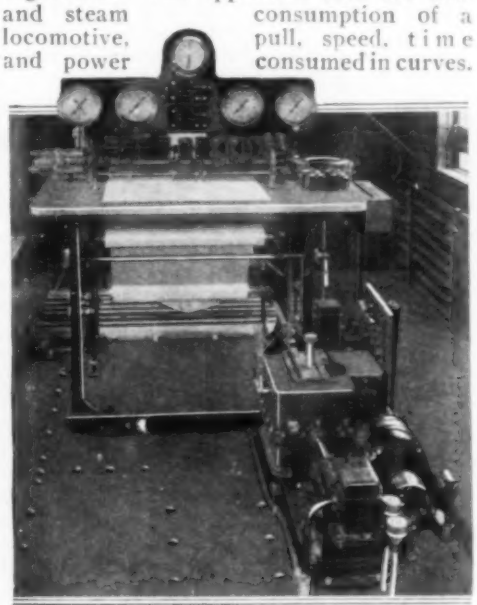
Cigar-shaped cars suspended in pairs from a single overhead rail and capable of running 100 miles an hour have been designed as a means of relieving traffic of big cities. Built of steel the cylindrical coaches, each of which is to be sixty feet long, are planned to seat 100 people, and can be used over the most crowded thoroughfares without materially interfering with street traffic. The track consists of a single elevated rail supported on a narrow structure, which the twin arrangement of the cars straddles like a packsaddle. Because of their great capacity, speed and small rail requirements, it is claimed the vehicles would reduce travel time and decrease cost of railway installations.

Rays Are Given Off by All Living Things, Is Claim

All living things are radioactive and insects and leaves of plants emit rays sufficiently strong to be photographed on a sensitive plate, according to a French scientist. By means of the pictures so taken, he has estimated that certain kinds of bugs have a greater degree of radioactivity than some chemicals commonly used in making laboratory tests and comparisons of materials. No such rays have been detected from dead organisms and therefore the property is believed to be an accompaniment of life itself.

Force of Train Shocks Is Revealed by Dynamometer Car

Secrets of modern transportation are revealed by a dynamometer car which records train and locomotive performance. The recording table is provided with indicating gauges and recording pens, and every impact and shock is automatically registered. The apparatus tells the coal and steam consumption of a locomotive, pull, speed, time and power consumed in curves.



Car Equipped with Automatic Instruments Which Measure Impacts and Record Locomotive Performance

Safety Light on Rear Auto Fender Also Serves for Repairs

Easily mounted on the rear right fender of any automobile, an electric lamp of the headlight type has been designed which,

Inspecting Automobile with Fender Light That Can Be Carried to Any Part of Machine

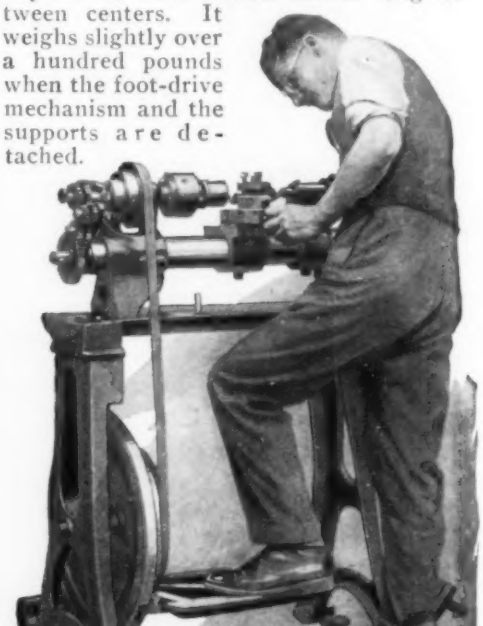
it is claimed, illuminates the entire outer rim of the road for hundreds of feet ahead. Signs, danger warnings and obstructions near the highway can be readily seen without any manipulation on the part of the driver. The light is supplied with enough wire, concealed on a reel, so that it can be removed and carried anywhere about the machine for inspection or emergency repairs.

"Inverted Wells" Dug in River Beds to Save Water Supply

Digging wells in the bed of a river to save the water supply seems like nonsense, but that is what engineers in the Santa Clara valley in California are planning to do for the sake of the 116,000 acres of prune trees. The unusual method is proposed as a means of keeping the natural water supply from running into San Francisco bay. The region normally is provided with abundant artesian water from the mountains. For years it has percolated into the underlying gravel beds where it spread to the entire valley. But lately clay washed down with the freshets has formed a sort of blanket over which the water has passed without sinking into the lower strata. The "inverted wells," as they have been called, will penetrate this accumulation of silt and allow the streams to soak down to their natural reservoir of gravel and coarse sand. Advocates of this plan point out that it will save the cost of building large dams and other irrigation projects.

Lathe with Circular Bed Fills Needs of Home Workshop

Furnishing almost complete workshop equipment for amateur mechanics and modelmakers, a lathe with a round, hollow bed in which the lead screw runs, has been designed by an English manufacturer. This arrangement is said to protect the covered mechanism from dirt and metal chips. The drive is by means of a comparatively large cone pulley constructed for a flat belt which transmits sufficient power from a pedal for any work done on the machine and makes back-gearing unnecessary. Almost any type of thread can be cut on the tool with a set of change wheels, and plain milling and boring can be readily handled, as the saddle can be partly rotated around the bed and locked at any angle without interfering with the working of the transport gear. The lathe has an over-all length of nearly three feet and can take a piece of work eleven inches long between centers. It weighs slightly over a hundred pounds when the foot-drive mechanism and the supports are detached.



Foot-Power Lathe with Cylindrical Bed in Which Lead Screw Runs and Is Protected

© R. R. Doubleday

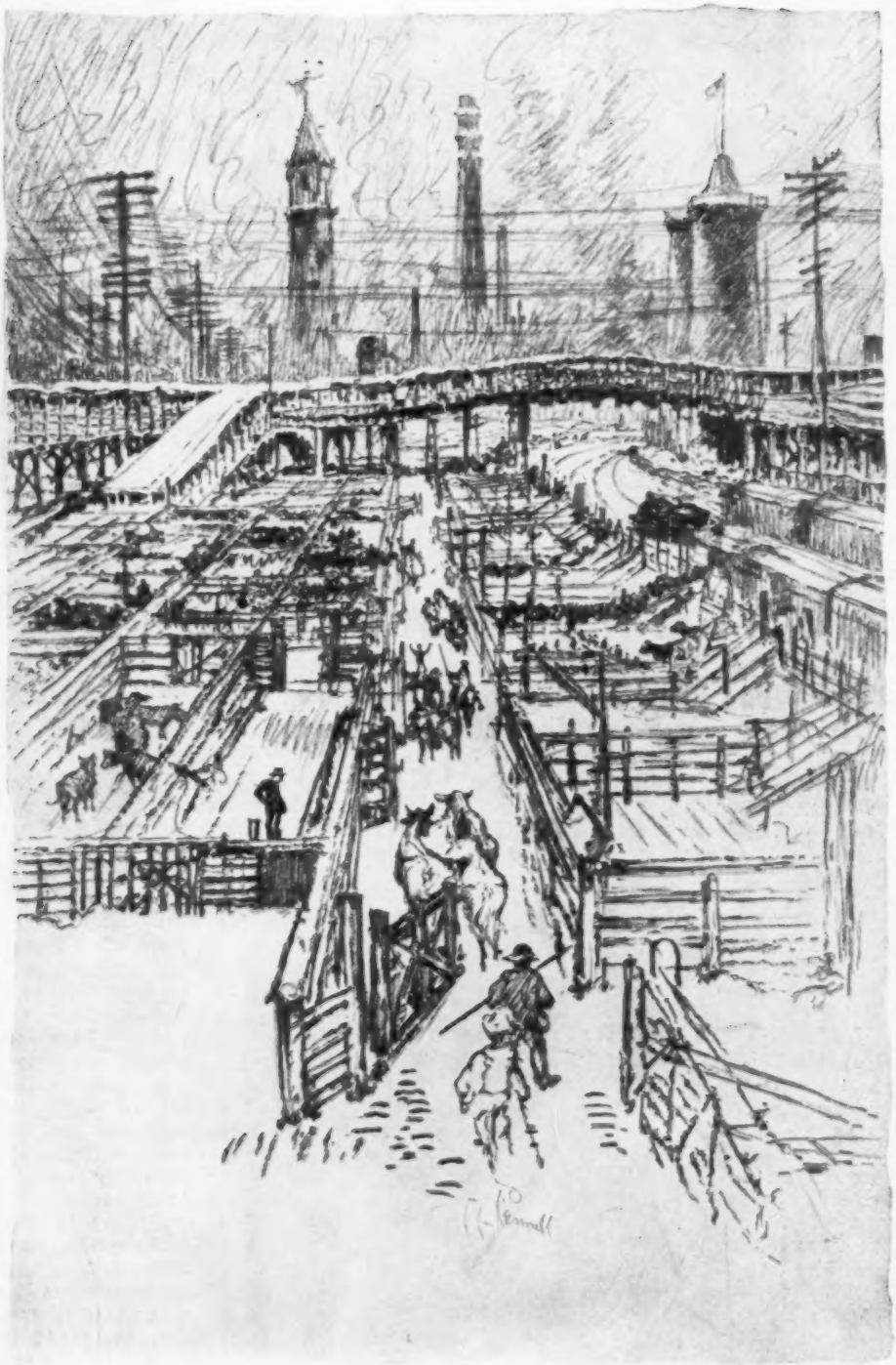
Stunt Riding on a Well-Trained Pinto Cow Pony at a Rodeo in the Southwest

Wanted: A Use for the Pig's Squeal

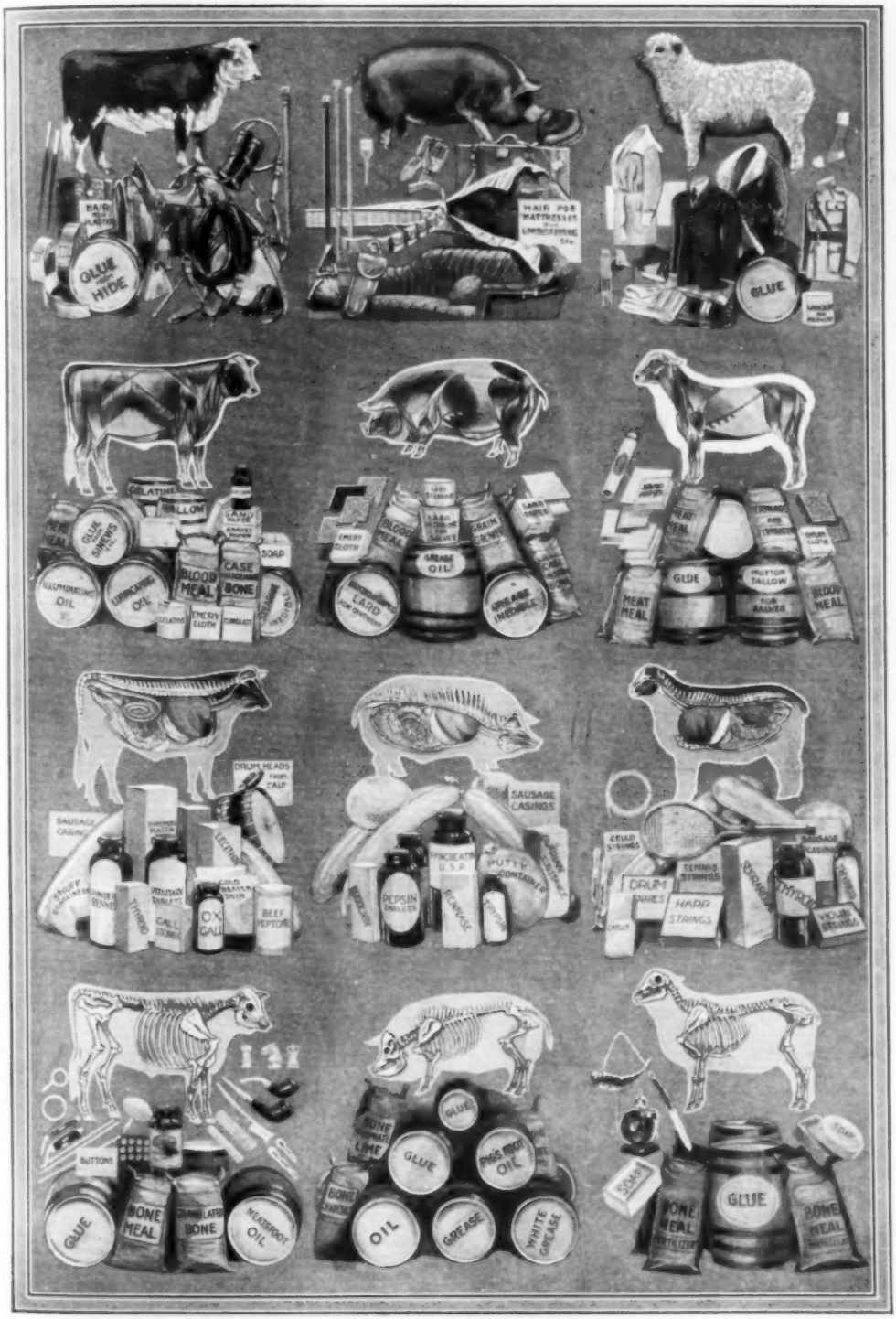
Packers, Long Held Up to View as Models of Industrial Efficiency, Also Have a Few Other By-Products for Inventor's Use

THE plants of "Packingtown," where, according to fabled story, everything but the squeal of the porker is utilized, have long been cited as models of industrial efficiency, but, as a matter of fact, the packers still have a few by-products for which no use has been found. When all the meat and all the by-products of an animal are weighed up, there is a shrinkage of from ten to twenty per cent from the weight of the animal when it was purchased, on the hoof. If anybody finds a way to obviate that loss, the price of meat will be reduced. The loss, though, represents unrecoverable elements for which, it is believed, no use will ever be found. As it is, the packers do remarkably well in converting waste into salable articles, though fluctuating market conditions at times upset all calculations. For example, there was the hairpin industry, once a flourishing business which converted spare bones into imitation tortoise-shell pins. Then someone conceived the idea of bobbed hair, and now the hairpin business prospers no more. A 1,000-pound steer yields only about 550 pounds of dressed meat, and there was a time when the other 450 pounds, with the exception of the hide, represented waste. In those days the meat and

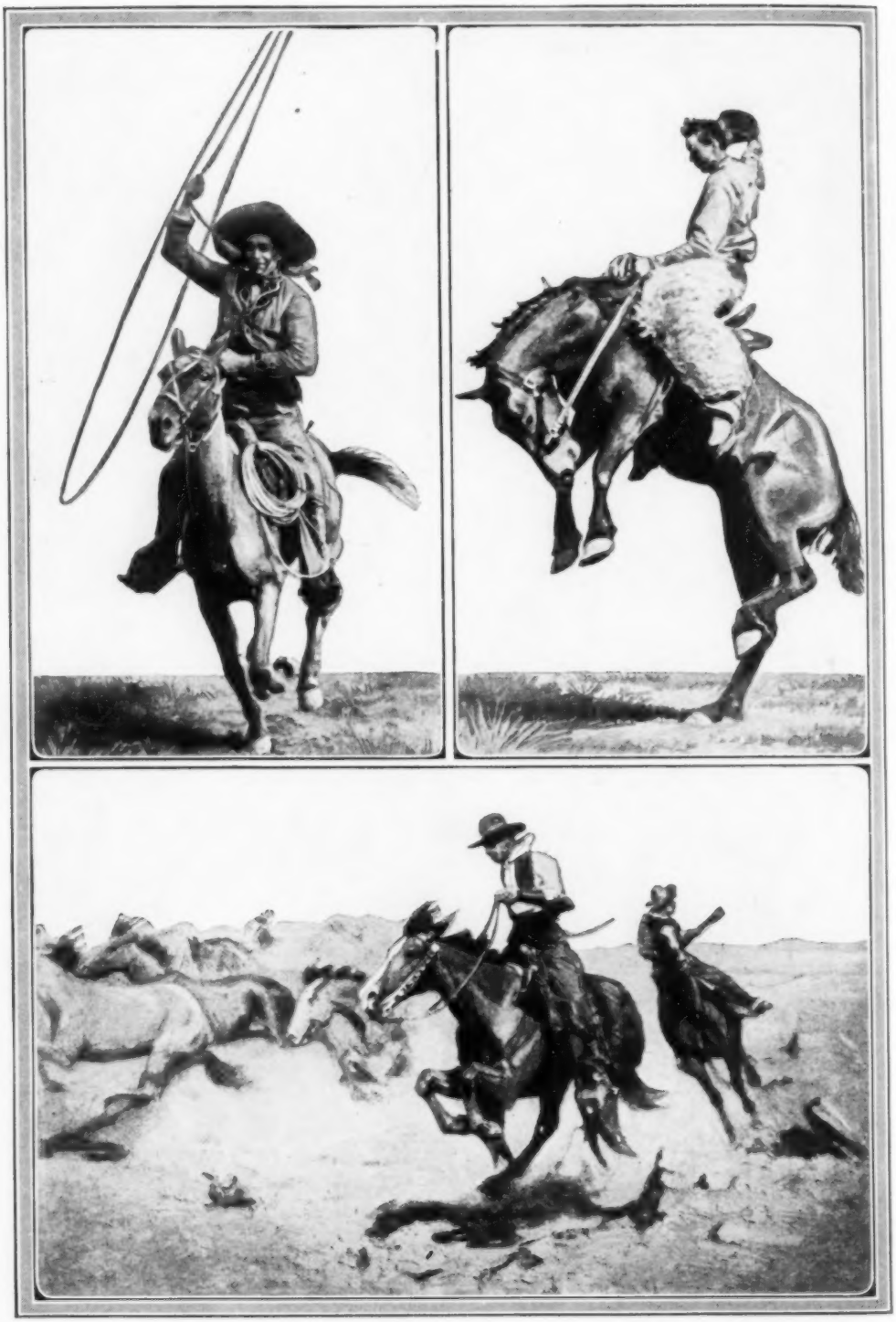
Chemists Preparing Medicines from Animal Glands in the Laboratory of a Packing Plant



Cattle Pour Out of the Railroad Cars, through the Pens of the Stockyards, and Then up the Inclines and over the Covered Bridges to the Killing Floors of the Packing Plants



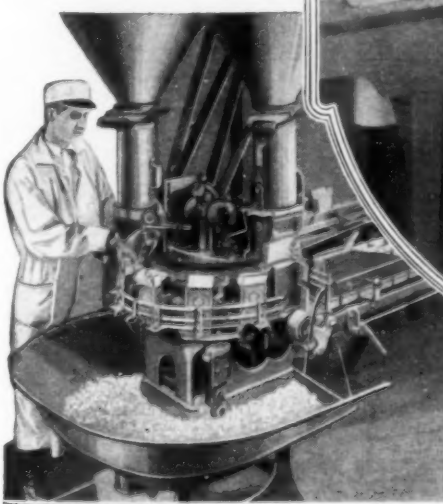
Some of the By-Products Saved by the Packers from the Hides, Meat, Intestines and Bones of the Thousands of Cattle, Hogs and Sheep Slaughtered Each Day in Their Plants



The Cowboys of the Yards, Above, Are Drawn from the Plains of the Southwest and Keep Up Their Skill in Frequent Rodeos; Below, a Wild-Horse Round-Up in the West

Curled Hair for Upholstery Is Made by Twisting Hair into Ropes, Using Cattle Horns for Tools, and Then Untwisting It

Oleomargarine Is Beaten and Worked Up in Huge Machines, Then Ladled into Trucks



Bottling Drugs in the Laboratory and, Left, Making Wool Soap Flakes in an Automatic Machine

the hide had to bring enough in the market to pay for the half-ton animal. Today, as a result of the work of scientists in developing the by-product business, the meat actually sells for less, at wholesale, than the animal cost on the hoof, yet there is a net profit of from one dollar to a dollar and a quarter on each steer.

The efficiency of the by-product business was made possible by two things —the large-scale operations of the centralized packing house, and the development of mechanical refrigeration, which enabled the preservation of such things as tiny unedible glands until a sufficient supply had been gathered to turn them into pharmaceutical products of great value.

The packing plants divide their by-products into four classes: first, those that come from the exterior, the hide, wool and hair, and the horns; second, the by-products of the meat layer; third, the by-products of the intestines; and lastly those recovered from the bones of the skeleton. The outer covering of the steer produces leather for shoes, harness, saddles, whips, belting, puttees, purses and hundreds of other articles; it yields hair for plastering; glue from the hide; umbrella handles and other articles from the horns; and even "camel's hair" for brushes, made from the stiff hairs plucked from the inside of the ears. The meat layer by-products range from illuminating oil to sandpaper, garnet paper and emery cloth, all made from glue recovered from the sinews, and likewise include meat meal, lubricating oil, inedible gelatin and tallow, candles, glycerin, soap, blood meal, casehardening bone and stearin.

From the intestines come sausage casings, snuff containers, calf drumheads, ox gall, gall stones and many medicinal preparations, as well as gold beater's skin, whose uses range from protecting hammered gold leaf to lining the gas bags of the "Shenandoah" and other giant airships. The fourth layer of the steer, the skeleton, yields bone for toothbrush handles, pipe stems, chessmen, teething rings, knife handles, knitting needles, buttons, combs, hairpins, as well as glue, bone meal, granulated bone and neat's-foot oil.

When all the by-products have been extracted, there remains the tankage—vast vats filled with the blood from the slaughtering houses and the waste and residue from the lard and tallow plants. A hot-air drier reduces the tankage to a dry substance, ready to be sacked and returned to the farms from which the cattle came and aid in raising more hay and corn to feed more cattle, which eventually will come back to the packing house.

Texas "Cow Town" of Twenty Years Ago, When the First Automobile on the Plains, Proudly Displayed by Its Owner, Heralded the Passing of the Horse for All Purposes but Work on the Range

Canadian Trapper and His Pet Moose Crossing a Lake with the Canoe Hitched to the Swimming Animal's Antlers by Ropes, Which Also Serve as Reins to Guide the Beast

Moose Pulls Boat While Swimming with Rope Tied to Antlers

A pet moose owned by a trapper near Lake Nipegon, Canada, is trained to swim with a canoe hitched to its antlers. Accustomed to obey the commands of the "driver," the animal is easily directed by the reins, which also serve as traces held in the hands of the hunter. This method of propelling the craft, while much slower than the paddle or an engine, helps to save the trapper's strength for other work while seeking game.

Power of Sun Stored by Plants May Solve Fuel Problem

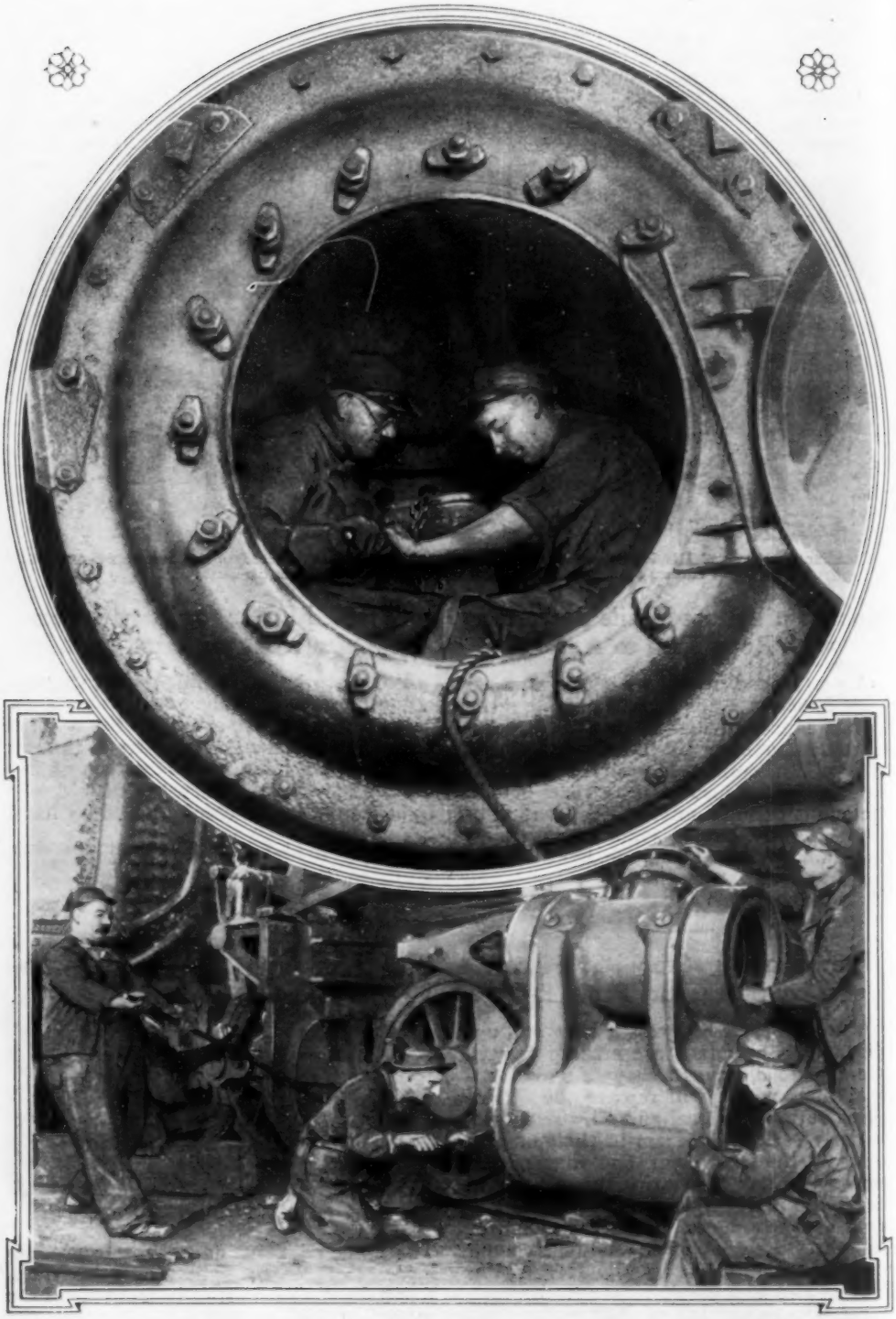
Although their progress is slow and unspectacular, scientists are making dogged attempts to discover a way to make artificial fuels which will replace the diminishing supplies of coal and oil. The process they seek to perform in their laboratories is the marvelous one that nature uses every day in storing up energy in leaves and plants by converting waste material into wood, etc., under the action of sunlight. Solution of the riddle is being sought in California by Dr. Herman A. Spoehr and a staff of research workers. A year's consumption of coal at the present time, represents the accumulation of 100 years, he says.

Traffic Marker for Busy Streets Does Work of Many Men

For placing traffic guide lines on streets, a southern inventor has devised an apparatus which he claims will do the work of ten men, easily marking a strip at the rate of 200 feet a minute. It consists of two tanks and a series of brushes carried on a light four-wheeled truck pushed by hand.

Painting Traffic Guide Line with Marker Truck

The paint runs through a nozzle producing lines three to eight inches in width. Revolving spiral bristles in front clean the pavement and as the spray reaches the surface its edges are smoothed by brushes on the sides.



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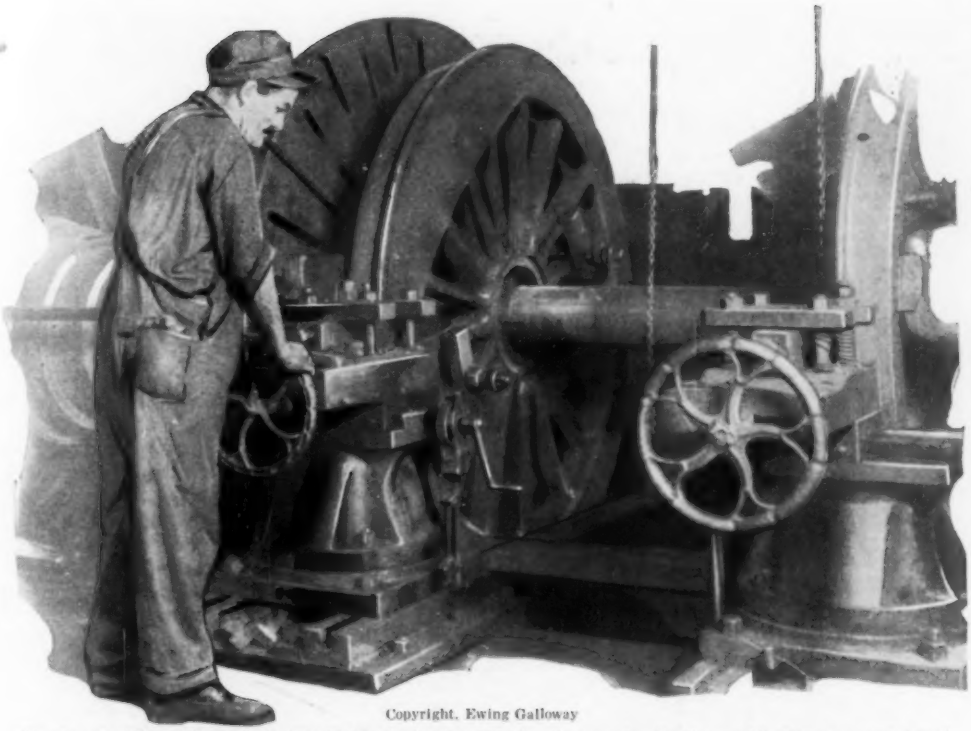
When Iron Horses Go to the Hospital—Men Grinding Exhaust Joint in a Locomotive Smokebox; Below, Overhauling the Huge Cylinder of a Twenty-Four-Drivewheel Engine



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Turning the Tire of One of the Big Drivewheels of a 400-Ton Locomotive Is Done with Accuracy and Speed by Skilled Worker on Monster Lathe

Behind Scenes in a Railway Terminal

How the Roads Protect Lives and Property by Car Inspections and Cleanings in Busy Yards near Big City Depots

BEHIND the scenes of every big railroad terminal is a bustling repair and inspection yard where cars are washed and renovated and carefully examined for defects before they are taken to the stations or loading platforms. An army of workers toil here day and night replacing worn-out wheels, brake shoes and other minor parts. Every one of the country's 55,000 passenger cars receives many cleanings and inspections yearly. Similar repairs and examinations are made in other yards on the 2,500,000 freight cars the railroads own, and in the roundhouses, the 65,000 locomotives are constantly being watched for breakage and wear.

The passenger-coach yard, with its necessary buildings, is mainly a series of stub tracks running from one or more leads to the terminal shed and the main line. Among these tracks spreads, underground or overhead, a network of steam, water, compressed-air, electric and a few surviving gas mains for heating the cars, filling tanks, making air-brake tests, for lighting and for charging batteries. The yard is a service station on a big scale.

Workers are relayed in three shifts of eight hours each, beginning at seven o'clock in the morning. Their duties start as soon as a train reaches the terminal. Almost before passengers have grabbed their baggage, inspectors are running down the sides of the cars, opening the lids to the journal boxes. They feel among the soft woolen waste that had been soaked in oil for forty-eight hours before it was placed there, for signs of a hot box. The lids are left open as the train is taken back to the yards, where a series of inspections follows. Whenever broken parts are discovered they are noted on a bad-order report. This is in duplicate. One copy goes to the foreman

of car repairs and the other to the yardmaster, so that he can order the car set on the proper track and, if necessary, held out from those that are to be used in making up trains.

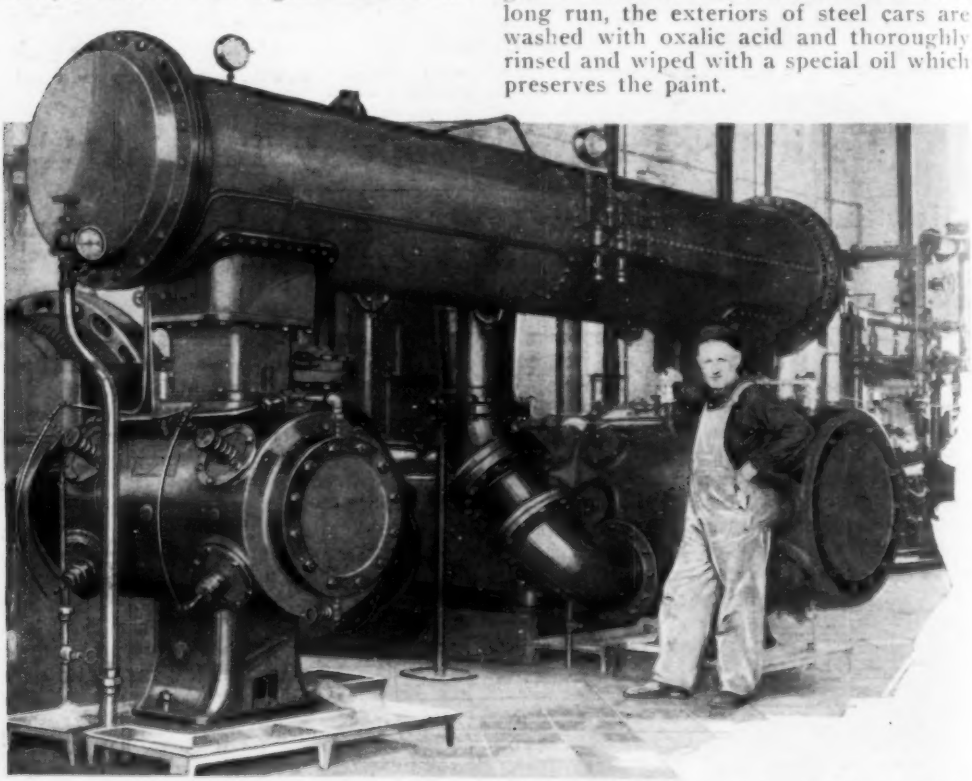
A modern steel car will last from 200,000 to 250,000 miles, but careful watch has to be kept for worn flanges and "flats." The inspector runs a practiced thumb and forefinger around the flange. If it feels suspiciously thin, he applies a steel gauge, a flat piece of steel with grooves cut in the side that fit over the edge. If this has worn more than fifteen-sixteenths of an inch, the wheel is condemned. Powerful jacks are slipped under the car, the truck is taken off and another put on. Putting wheels on a seventy-five-ton car, to the layman seems like a big job. Three skilled railroad men with modern equipment can do it in forty minutes.

On their rounds, the various inspectors carefully examine every one of the 200 or more parts on passenger cars that are liable to get out of order. These include doors, windows, plumbing—more than 200 feet of it in many cars—radiators, seats, conductor's air signal and fire extinguishers. The car truck, bulky and sturdy as it is, has from seventy-five to eighty parts, any one of which, if broken, might cause serious trouble. As the inspectors pass along, they check the parts to be repaired on a card which is placed in a conspicuous position on the car. A marker follows, chalking on the side the date and the number of the track to which the car is to be taken for repairs. In the freight service, the position of the card often indicates the degree of overhauling that will be needed.

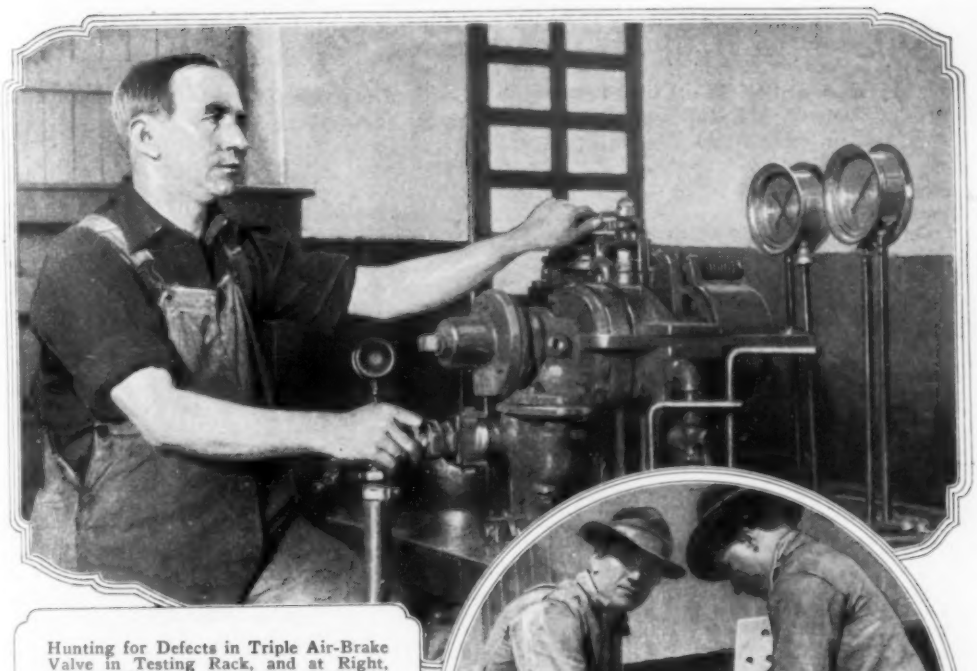
Many passenger cars today are fitted up as separate electric-power plants with generators and storage batteries. These and all the lamps, fans and wiring must be inspected regularly.

With modern equipment, the brakes of a whole train, or of a single car, while standing still in the yards, can be given trials that practically duplicate the requirements of an actual run on the road.

While the inspectors are going about, the car cleaners, with a clutter of mops, special ladders, rags, sponges and machines, have started work. To remove the grime and dust of several states after a long run, the exteriors of steel cars are washed with oxalic acid and thoroughly rinsed and wiped with a special oil which preserves the paint.

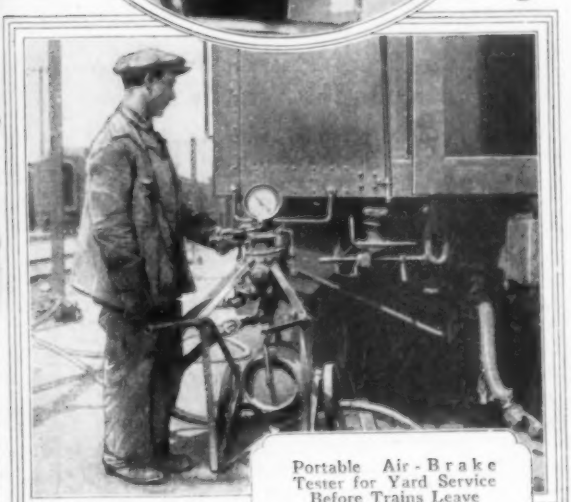


Big Compressor and Storage Tank, the Source of the Air for Making Brake Tests, Operating Cleaners and Various Repair Tools in Coach Yards and Shops



Hunting for Defects in Triple Air-Brake Valve in Testing Rack, and at Right, Cutting Holes in Metal Bar with Air-Motor Drill

In Almost Any Coach Yard, the Car Cleaner with His Vacuum Outfit and Dust-Trap Bag, That Catches the Dirt Removed by Powerful Suction, Is a Familiar Sight



Portable Air-Brake Tester for Yard Service Before Trains Leave

Markers at Scenes of Auto Deaths Warn Drivers against Speeding

"One Was Killed Here." These four words, printed on a blue card hung at spots where automobile fatalities have

Warning Sign for Motorists by Which It Is Hoped Auto Fatalities Will Be Reduced

occurred in Chicago, grimly remind drivers of the dangers of speeding and silently warn of the importance of caution. Erection of the signs was sponsored by a safety committee and the work was done by a delegation of boy scouts. The cards, though only 180 square inches in size, are visible at a considerable distance.

Newspaper Pages Flashed by Radio Is Prediction for Near Future

Transatlantic transmission of photographs and newspaper pages by radio is a development likely to become a reality in the near future according to Maj. Gen. J. G. Harbord, president of the Radio Corporation of America. Two-way talk by radiophones he also regards as an imminent possibility. A ticker that will actually print words on paper from a central broadcasting point, thus greatly amplifying present news-distributing agencies, is another of the objectives of radio-research engineers, and control of airplanes, submarines and other ships from a remote land station is, he believes, a possibility certain to be realized in view of the astounding progress already made in radio accomplishments.

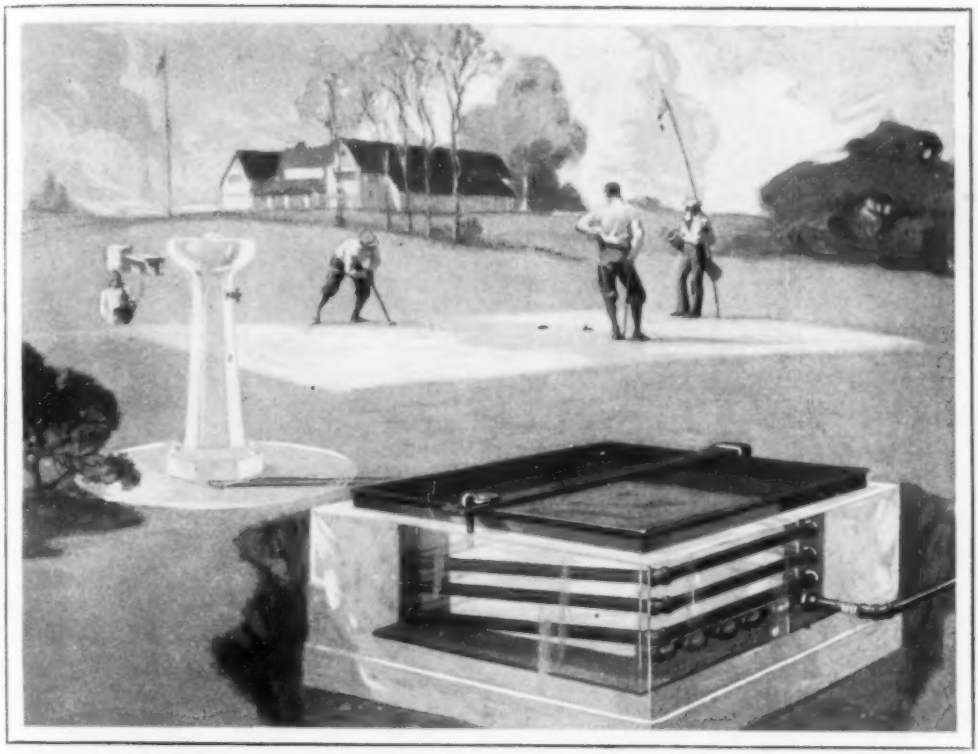
Outside and Inside Temperatures Given by Double Thermometer

A thermometer which records the room temperature, and at the same time gives the outside conditions, both in degrees and as summer heat, warm, cool, cold, freezing or below zero, is now on the market. Beneath the ordinary spirit thermometer, which records the inside temperature, is the dial of a recording instrument, based on the same principle as an automobile radiator indicator, and with an outdoor connection by wire through a groove along the edge of a window. The dial is graduated in degrees at the top, running from forty below zero at the left to 120 above at the right. At the bottom are the equivalent terms, reading in the opposite direction. A single, double-tipped hand extends across the dial and is pivoted at the center, so that as it moves it gives the correct reading on both scales.

Hot Electric Cooker Cover Browns Foods on Top

With heating elements in its cover as well as in the bottom, an electric cooker that browns foods on top, and bakes and roasts them, has been placed on the market. Designed like a fireless-cooker cabinet, it has convenient receptacles for the foods and hot plates for frying. It will perform practically every common cooking operation and its insulated construction is such that, after foods are heated to the steaming point, the current can be shut off and cooking completed with heat stored in the sides of the cabinet.

Electric Cooker with Hot Plates for Frying and Baking That Fit Inside



Water Cooler Installed Close to Drinking Fountain on Golf Links; Pipes Fitted in Hollow Square Form Convenient Ice Space, and Thick Concrete Wall Provides Insulation

Underground Ice Box Cools Water for Outdoor Drinking Fountains

Cold drinking water for outdoor bubbling fountains in parks, golf links and similar places is assured by means of a sunken concrete chamber for a pipe coil and a cake of ice. Tightly covered and secured by a flat lid with a lock, it does not obstruct the field, is inexpensive and requires but little ice. It is especially practical where the feed pipes are so near the surface that water ordinarily gets too warm to be refreshing.

Invisible Glove for Workers' Hands Makes Them Easy to Clean

Hands soiled with tar, oil, paint, engine grease or similar stains, can be washed clean easily and quickly with cold water, if an invisible glove of a cream preparation is rubbed on before work is started, manufacturers of the article assert. No scrubbing or violent rubbing is required as the substance keeps the dirt from getting into the pores of the skin. The cream is thin, does not interfere with the workman's toil, and as it is antiseptic, it aids in preventing infection of accidental wounds or cuts.

Razor Stropper Roughens Leather to Give Blade Keener Edge

Keener edges for safety-razor blades are said to be possible in less time with a handy stropper that has a knurled fiber roller to lift the nap of the leather every time a stroke is taken, keeping it rough and preventing it from becoming glazed and hard. The roller also helps hold the

Razor Stropper in Use, and Inset Showing the Knurled Fiber Roller That Roughens Leather

blade in contact with the strop at the proper angle, as its small cross grooves firmly grip the surface whether the movement is forward or reverse.

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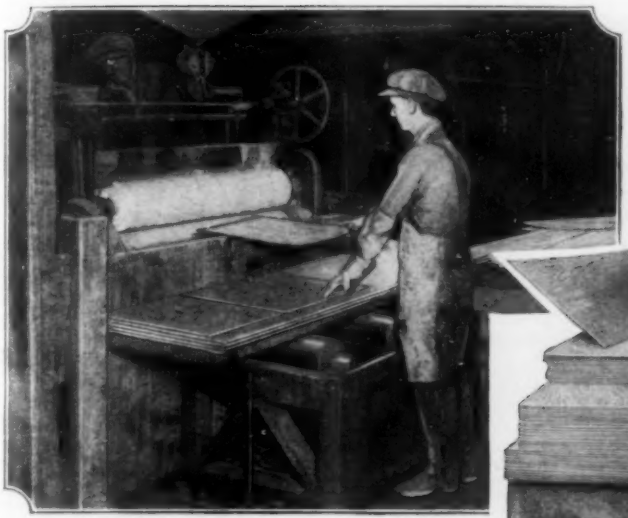
Scenes in the Timberland, Such as the Movement of This Giant "Mill Length" to the Busy Saws, Are Becoming Scarcer under the Tireless Harvest of the Lumberjacks



Glue Spreader into Which Center Cores Are Fed for Coating Before Outer Pieces Are Applied

Grading Finished Panels for Beauty of Grain and Desirable Sizes

Ply Board to Solve Lumber Shortage

Thin Ribbons of Wood Become Sturdy Slabs of High-Grade Material under Pressure of Powerful Machines

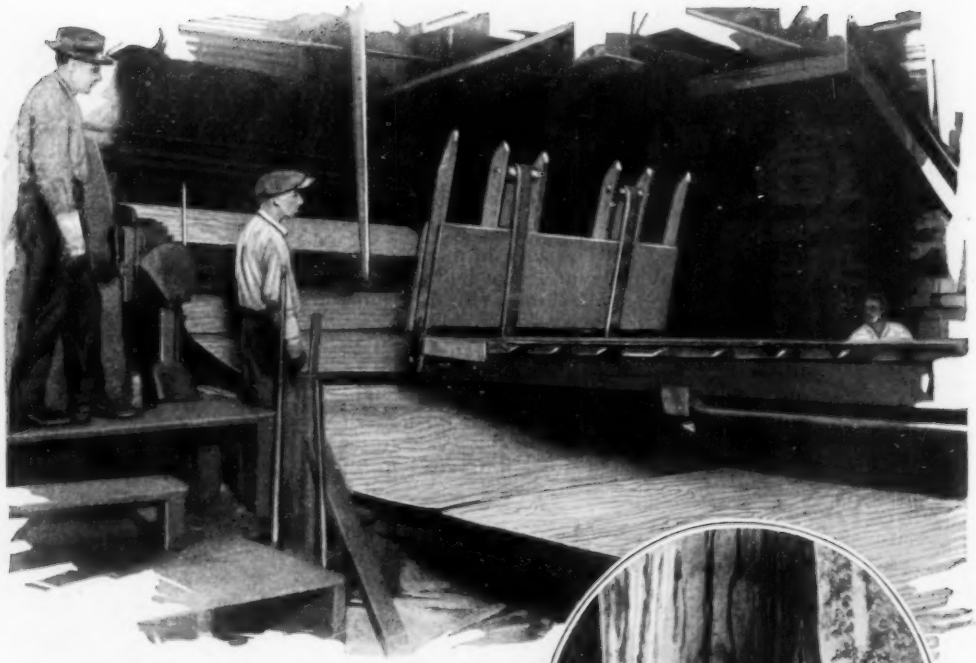
THE steady decline in production of first-grade lumber, due to shortage of available timber stands, has resulted in the establishment of the ply-board industry, a manufacturing process that utilizes practically every inch of a dressed saw log and produces built-up slabs of wood made from several thin layers glued and pressed to a core or center ply.

In the finished state these panels appear as solid pieces, smoothly surfaced and capable of being worked for almost any purpose with the same ease and adaptability as ordinary boards.

In a modern ply-board factory huge saw logs, in the rough, enter one end of the plant and emerge at the other in literally miles of sturdy panels. Logs of selected Douglas fir are used and are cut into short lengths, usually six to eight feet, which are shunted into steam chambers. While still retaining the bark as they came from the woods, the pieces are steamed under high pressure for forty-eight hours to neutralize the pitch and soften the texture of the timber. They are then conveyed to a lathe where the bark is removed and the inner surface set in contact with a large keen-edged peeling blade. As the log is made to revolve against the knife, the wood rolls away in a steaming ribbon, one-seventh of an inch thick, resting on an endless belt about a hundred feet in length. From this strip sections sixty to seventy feet long are trimmed and passed to a clipper, which cuts them into desired widths and eliminates the waste or knotty pieces before the sheets go to automatic driers where hundreds of hollow steam-heated steel rollers prevent the "slices" from warping. Emerging perfectly dry and flat, the boards are graded. Those having small knots or lacking the grain required for fine panel work are cut into short lengths for cores.

Great care is exercised to keep all imperfect material from being used as surface slabs, for most of the finished lumber is made up for parts of furniture, house decoration, vehicles, trunks and countless other similar uses.

The sheets of cores are fed into a gluing machine which spreads adhesive over both surfaces, expert handling insuring that it is put on uniformly. This material is mixed in the factory, the base be-



ing composed of casein, obtained from cows' milk. Lavender in color and waterproof, it is applied at a consistency to give the greatest adhesive strength without excessive hardness, a condition that might injure the saws when the wood is worked.

Coming from the gluers, the cores are laid by hand on the surface sheets of the panels and the top board is then placed on the other side of the center ply. Panels are made in three, five, seven or nine plies, depending on the use to which they are to be put. After assembling, they go to hydraulic presses where they are subjected to a pressure of from 2,000 to 4,000 pounds according to thickness. This squeeze is maintained for about twenty-four hours or until the glue has set.

From the press room the panels are taken to saws where all rough edges are trimmed off and the slabs are trued. They are next cut up into standard stock sizes or in accordance with special specifications. Before shipping or storage all the pieces are dressed to a smooth, velvety finish on sanding machines which leave a surface that can be readily painted or treated by any of the familiar methods of decoration. If any small burrs or ragged corners are left, a final inspection results in the return of the panels to the sanders. Usually the slabs are prepared in sizes from twelve to forty-eight inches wide and from forty-eight to ninety-six inches long.

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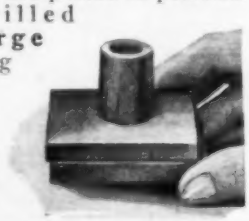
Sawyers Working through a Massive Tree; Above, Log Unrolling from the Peeling Blade in a Ribbon of Wood

Magnetism Audible by Aid of a Loud Speaker

Noises caused by the action of a magnet on a piece of iron were made to sound like a roar by the aid of a loud speaker and a device perfected by an electrical concern. While outwardly no change is apparent when the metal is magnetized, scientists hold the theory that magnetism causes a rearrangement of the atoms within the iron forcing all of them to lie in the same direction. The sound producer consists of a piece of soft iron inserted in a coil of 17,000 turns of wire connected to an amplifier, which is attached to either headphones or a loud speaker. When a magnet is brought near the iron, a rustle is heard. If the approach is rapid, the noise is loud and abrupt, but if slow, it is faint and lasts longer. While the magnet is being removed similar sounds result. If the current is reversed while the magnet is close to the metal, a sharp racket is heard.

Rivets Exploded by Hammer to Aid in Salvage

Explosive rivets that can be closed from the outside by setting off an inner powder cartridge have been patented by an English inventor. It is expected that they will prove of special advantage in salvage operations where the diver cannot reach the interior of a sunken ship and for attaching steel-plate patches over holes in the ship's sides or lifting straps for a crane. The plates or straps are placed in position and holes are drilled through just large enough for inserting the rivets. At the center of the rivet is a small opening, running about three quarters of its length and in this a powder cartridge is placed. When the rivet is adjusted, the charge is exploded by a blow of a hammer and the resulting pressure bulges out the free end of the rivet which projects inside the ship, thus forming an effective head.



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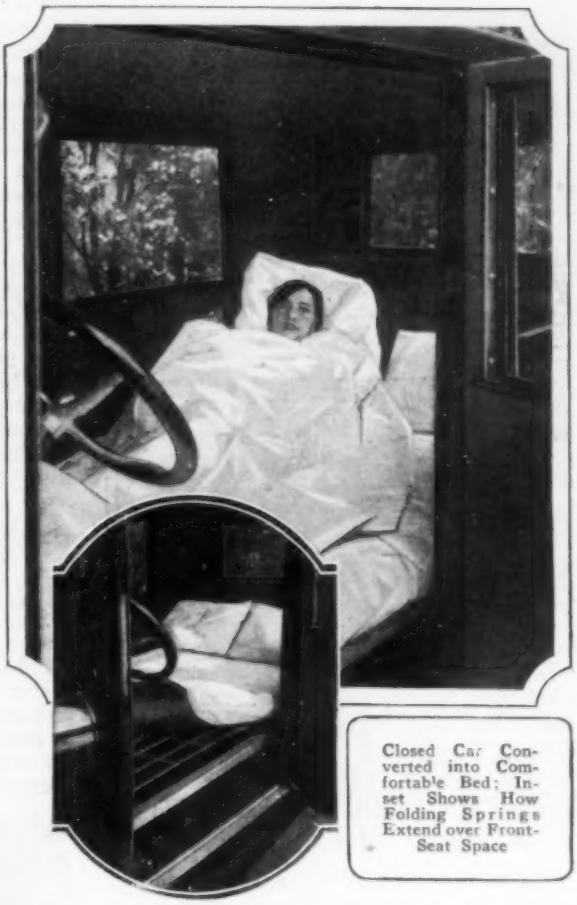


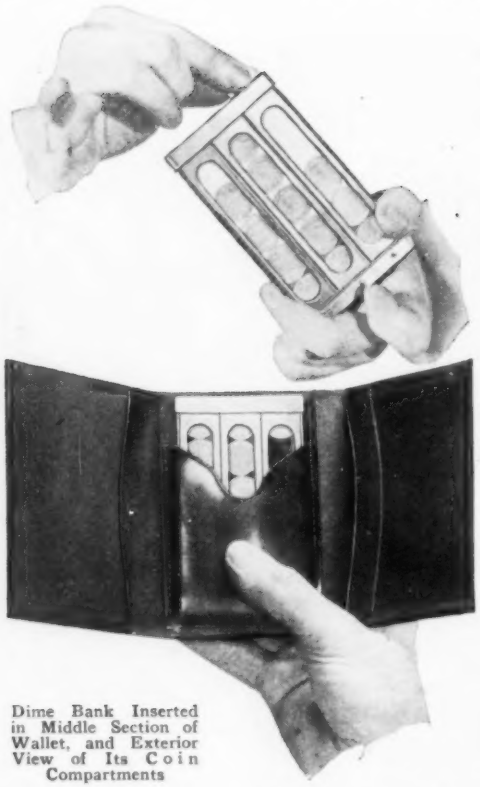
Closed Car Converted into Comfortable Bed; Inset Shows How Folding Springs Extend over Front-Seat Space

Bed with Springs Built in Auto Solves Camping Question

A Pullman-type berth built into a closed motor car has been designed for the convenience of tourists. A folding spring rest, which rolls into a compact package to be disposed behind the rear-seat upholstery, forms the base of the bed. The mattress becomes the rear-seat cushion when the bed is not in use. The front seats are made easily removable.

Buried Indian City Is Found

Almost a hundred years ago, mention was made, in a letter written by a western plainsman, of a buried Indian city in southeastern Nevada. Scientists at last have verified the report with the finding of a stretch of sand-covered ruins of stone and adobe dwellings that apparently formed a pueblo city of some 20,000 population, 3,000 years ago.



Dime Bank Inserted in Middle Section of Wallet, and Exterior View of Its Coin Compartments

Visible Dime Bank Carried in Wallet Is Constant Reminder to Save

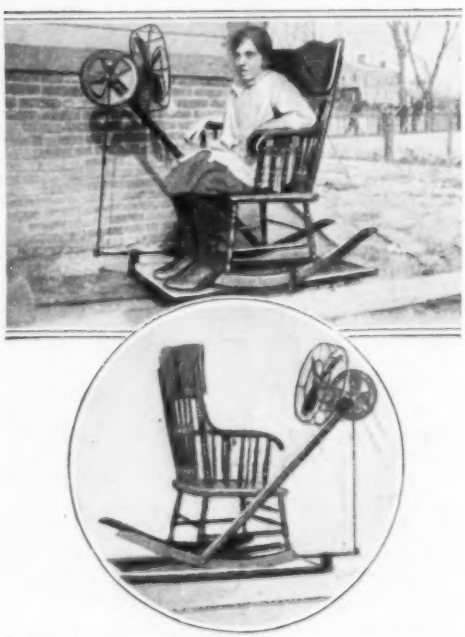
As an aid to Christmas savings clubs and similar plans devised by banks and other institutions to cultivate thrift, a dime bank that fits inside the center pocket of a serviceable wallet has been designed. It is a visible and constant reminder of the resolve to save money, prevents the coins from getting lost and enables the owner at a glance to tell just how much has accumulated toward the next deposit. The bank is made of aluminum and brass, weighs only an ounce and has six locks all of which are opened instantaneously by a handy unlocking device. The wallets are made of leather in both men's and women's styles.

Electric Track Layer Saves Labor in Building Railways

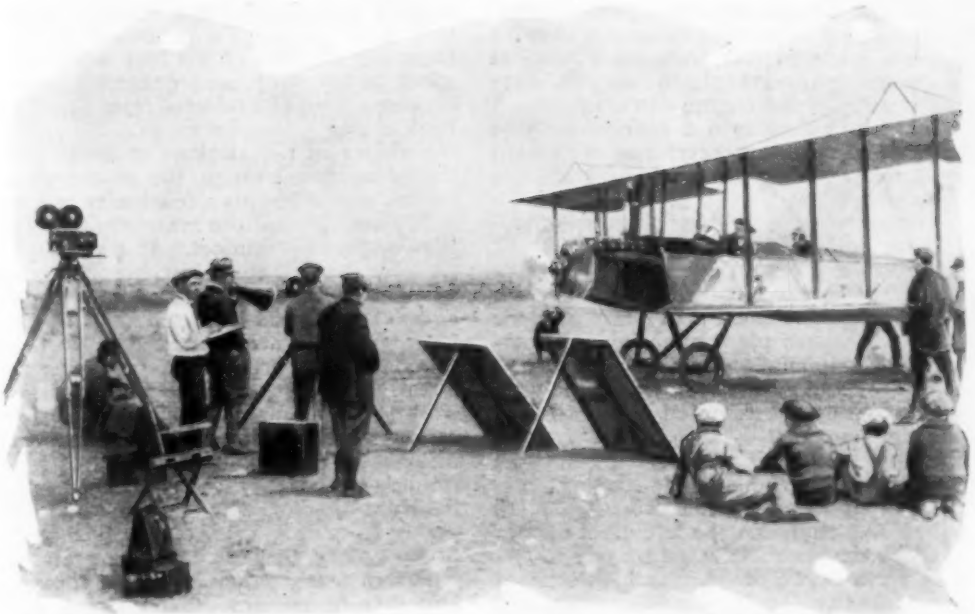
With a patented mechanical track layer, old rails and ties can be removed and new ones put down at the rate of more than half a mile in eight hours, according to reports of a recent test of the apparatus. The method involves two principal steps, assembly of the lengths at a central depot, where old track is also broken up and prepared for sale or re-use, and the actual laying of the new line on the roadbed. The first process is accomplished by power machinery and the second is done by a special train and an electrically operated cantilever truck. Loaded with sections, the cars are hauled to the site where the track is to be installed. A length of old rails and ties is lifted bodily from the roadbed and conveyed to the rear of the train. At almost the same time, a new section is interchanged for the used one, slid to the front and, when the ballast has been smoothed, is dropped into the place occupied by the old track. An important advantage claimed for this equipment is that it eliminates the need of handling rails and ties separately.

Fan Run by Power of Rocking-Chair Provides Cooling Breeze

Shaped like an ordinary electric fan, a device which operates by energy from a rocking-chair has been invented. It can be easily and quickly attached or detached, and creates a breeze as long as the chair is in motion. The fan is especially designed for use where absence of electric current prevents use of motor-driven blades.



Fan That Operates by Power Provided by Motion of Rocking-Chair



Shooting Airplane Scenes on Location in the Mojave Desert, Far from the Studio but Reached by Director and Staff in a Short Period of Travel through the Air

Airplanes in Moving Pictures

Aviation Brings Realism and Thrills to Screen Plays and Lends Speed to Busy Staffs Who Build Pictures

AIRPLANES, as yet too unwieldy for most purposes as part of stage plays, have become almost indispensable as aids to the motion-picture industry where, in addition to their value as thrill producers, they are to be found performing as time and labor-saving machines behind the camera. Because of their great speed and spectacular movements no opportunity is lost to include them as the principal properties in "dressing up" the dramatic action of critical scenes in productions which permit their use.

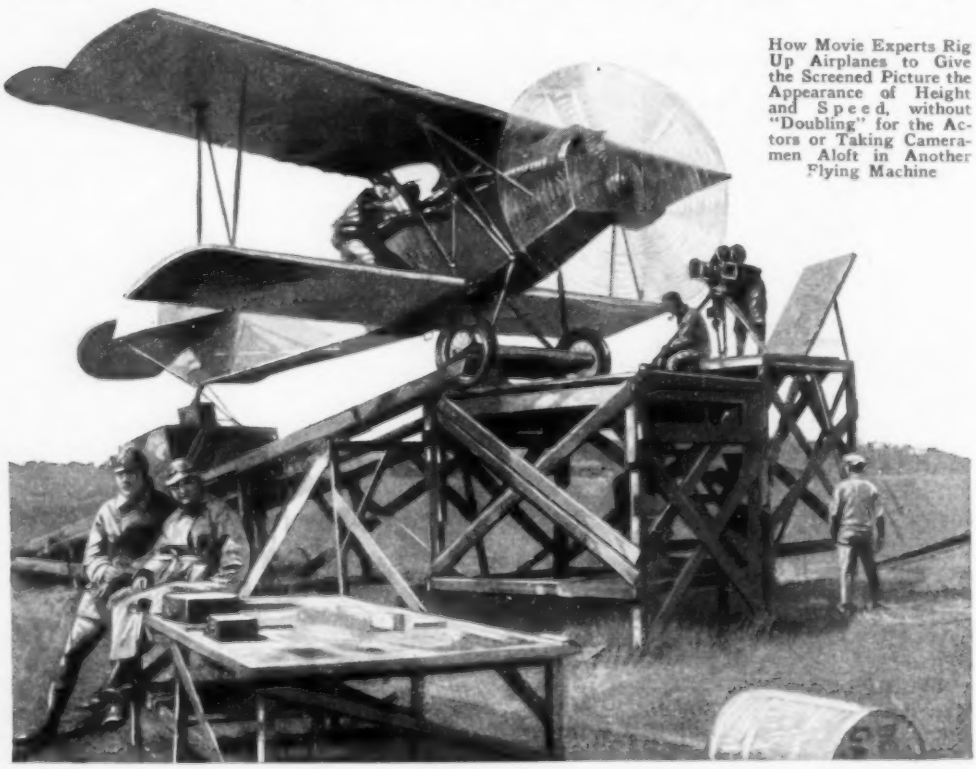
At first, the winged craft were introduced as a novel means of applying realism to plays, or to support performances of aerial stunt flyers often employed to "double" for other actors. But gradually they were called upon to serve such purposes as transporting the exposed film quickly over long distances between locations and the developing laboratories, and to carry busy directors from one point to another during the preparation of outdoor scenes. Now there is seldom a large production filmed without at least one great situation being "shot" from the air. Where mobs or mass views are desired, the cameraman and his equipment are taken aloft by the plane, which can circle any location at a speed and position to afford an impressive view of the activities on the set below. This method results in a spectacular picture with an effect that can be obtained in no other way.

It has also been found that the airplane's engine is almost limitless in ability to serve in the place of other machinery usually requiring the expenditure of much time and money to transport, even though it is constructed on the most portable lines. With the powerful motor and propeller, ordinary wind effects, hurricanes and rainstorms can be produced without the need of any other apparatus. So strong are the air movements made in this manner that the pressure can tear loose from the ground practically any objects that are not bolted down or deeply rooted in the earth. In one large popular screen play a battery of these agitators was installed around a setting of a country town,

and when put into operation, swept the entire group of structures into a pile of ruins several hundred feet from their original positions. Connected to an ordinary water supply, the engine can transform a fairly heavy flow into a roaring cascade capable of carrying everything in its path in a rush rivaling some of the strongest natural falls.

Often immense lighting circuits supplying the lights illuminating movie sets and buildings, are kept in operation by current made by generators geared to the engines of property airplanes. On many outdoor locations where night shooting is necessary, the ship might act as a means of saving hours and even days of valuable time by furnishing the required power to feed the big lamps that light up the areas, while the busy camera is transferred from one point to another filming the scenes.

In order to select and properly "plot" suitable locations for the filming of certain outdoor situations, it was formerly necessary for a movie director and his staff of assistants to traverse large areas of ground on foot, on horseback or by automobile. These trips required the exploration of remote and almost impassable land, for sometimes the most rugged country was needed, not only for the reality it might lend to the picture, but because of the surrounding scenery. Days and weeks were spent in this way, and generally several locations would be selected from which the final choice would be made. Now, with the ability of the airplane to cover practically unlimited range, the matter of selection may take only a few hours or a day at the most. And the searchers travel all the distance in comfort. If it be impossible for the ship to fly low, binoculars are brought to bear on the spot in question, and a fairly good idea of its worth as a location gained without need of overland travel. Large producing companies frequently have several groups of players working on as many widely separated locations, each under the direction of a member of the studio staff. All of these troupes must be personally checked up by the chief director, who may now be found racing from one place to the other in the cockpit of an airplane covering great distances in a few minutes, where formerly hours were required in motoring over rough winding roads or on horseback climbing narrow paths to the summit of some mountain where a screen thriller was getting much of its most tense action.



How Movie Experts Rig Up Airplanes to Give the Screened Picture the Appearance of Height and Speed, without "Doubling" for the Actors or Taking Cameramen Aloft in Another Flying Machine

Wire-Cloth Substitute for Glass Fills Many Needs

By treating coarse-mesh, galvanized-wire cloth with a transparent, flexible material that fills the spaces between the strands, a cheap, durable substitute for glass has been made for greenhouses, poultry shelters and coops, hot boxes and similar uses. It is furnished in rolls, three feet wide, up to 100 feet long and is put on like mosquito netting with staples and hammer, no putty or glazing points being needed. According to the manufacturers, it withstands hailstorms, is not affected by intense heat or cold and lets in almost as much light as glass without excluding the beneficial ultraviolet rays. It can be cut and trimmed with shears and bent double and straightened again without injury. Weighing only about one-tenth of a pound to the square foot, heavy and elaborately constructed frames for supporting it are not necessary. In case of accidental punctures, the holes are quickly repaired by application of a mending preparation. Cone-shaped shelters and little "tents" of this material are also furnished for protecting small growing plants, and it is also suited for windows in barns, garages and other outbuildings.

Strip of Wire-Cloth "Glass" Supporting Man, and Close View Showing Texture

Gas to Be U. S. Fuel of the Future According to Prediction

Solution of America's fuel problem lies in the economical use of coal for the manufacture of gas, according to Alexander Forward, secretary-manager of the American Gas association. There can be no permanent refuge in oil or water power, he declares, pointing out that the automobiles of the country alone, in five years will require 250,000,000 barrels of oil annually. Industries, which now use 60,000,000 horsepower, in a few years will require 100,000,000 horsepower, according to this authority, and even with the most rapid development in hydroelectric projects that public policy will permit, the saving in coal cannot compensate for the increasing demand.

Pipe Cleaner Forces Hot Water Through Clogged Stems

Designed somewhat like a miniature tire pump, a pipe cleaner now on the market forces hot water through the stem to remove obstructions and deposits. It has a rubber tip which is inserted in the bowl and is pressed down firmly to prevent the entrance of air. By operating a small plunger, hot water is sucked into the pipe and ejected again repeatedly until the stem is clean.

Electric Lawn Trimmer Cuts Edges Saving Work with Shears

To save time and labor in trimming lawn edges around sidewalks, trees and shrubbery, a Minnesota man has invented

Lawn Clipper in Operation; the Motor, with Cord Attached, Moving Cutting Blades in Front

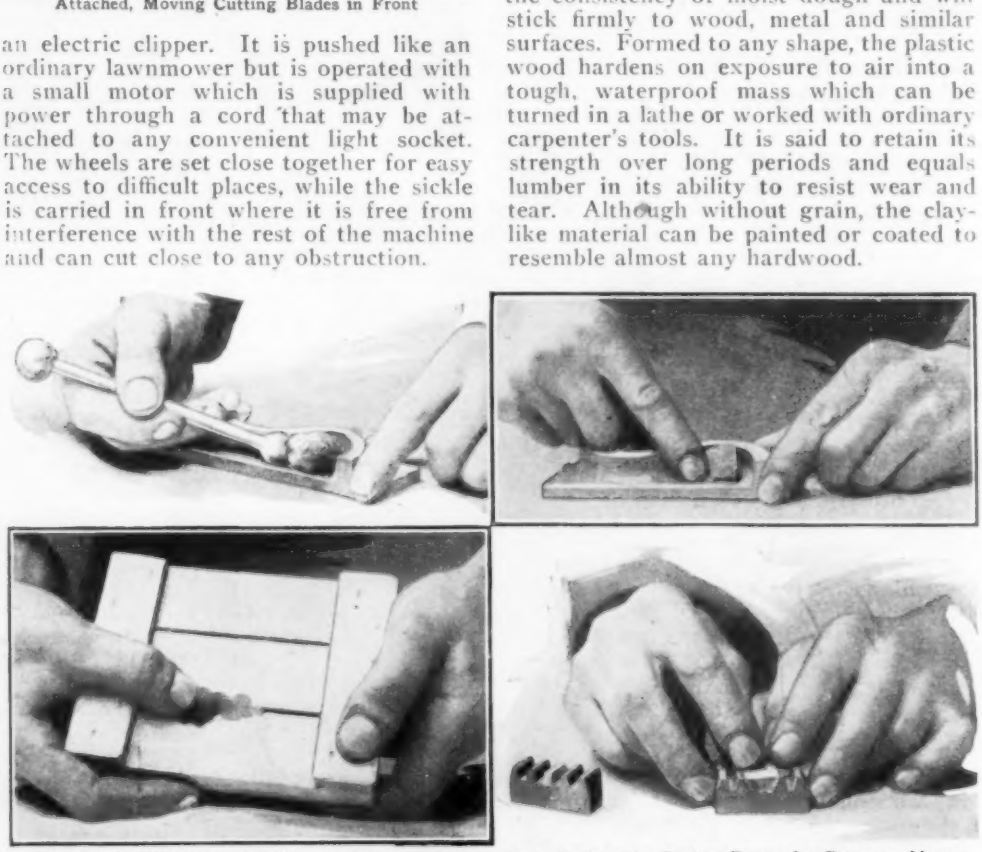
an electric clipper. It is pushed like an ordinary lawnmower but is operated with a small motor which is supplied with power through a cord that may be attached to any convenient light socket. The wheels are set close together for easy access to difficult places, while the sickle is carried in front where it is free from interference with the rest of the machine and can cut close to any obstruction.

Marconi Sees New Energy Source Unknown to Scientists

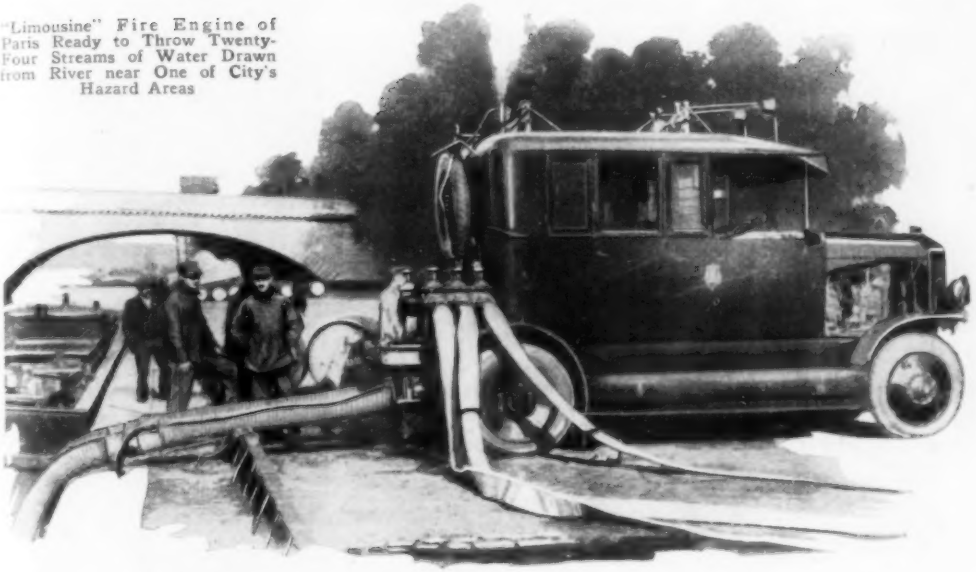
If the human eye were sensitive to ultra-red waves used in radio, the voice could be seen transformed into many flashes of brilliant light, according to Signor Marconi, inventor of wireless telegraphy, speaking from a broadcasting station in Italy. The scientist said he was convinced that there exists in nature a means for spreading energy which is still unknown to us. A new wireless apparatus has been devised which may make possible free communication between all parts of the world, the speaker said.

Plastic Wood Is Worked like Clay; Holds Nails When Dry

Wood in plastic form that can be molded by hand and hardens when dry so that nails and screws will hold in it, has been developed in London. The material is of the consistency of moist dough and will stick firmly to wood, metal and similar surfaces. Formed to any shape, the plastic wood hardens on exposure to air into a tough, waterproof mass which can be turned in a lathe or worked with ordinary carpenter's tools. It is said to retain its strength over long periods and equals lumber in its ability to resist wear and tear. Although without grain, the clay-like material can be painted or coated to resemble almost any hardwood.



How Plastic Wood May Be Used as Filler for Seams and to Replace the Broken Parts of a Pattern; Above, the Material Being Molded into Ornamental Shapes



"Limousine" Fire Engine of Paris Ready to Throw Twenty-Four Streams of Water Drawn from River near One of City's Hazard Areas

Fire Engine like Limousine Auto Feeds Twenty-Four Nozzles

Resembling a fashionable limousine, an automobile fire engine used by the Paris fire fighters can pump enough water to supply twenty-four nozzles. The closed body accommodates the fire crew and a powerful four-cylinder engine on the rear of the car feeds water to the hose. In cases of emergency, intake lines can be thrown into the river along the water front, near which many of the machines are stationed because of the frail condition of the buildings in that vicinity. It is said the speed of the trucks and their ability to rush through traffic greatly aid in the prevention of big fires.

Death Sign at Street Corner Gives Grim Warning of Danger

As a caution to jay walkers and those who disobey traffic signals, signs bearing a figure symbolizing death and inscribed with words of warning, have been erected at a prominent street intersection in a large eastern city in an effort to decrease the number of accidents resulting from the congested condition of the thoroughfares. Placed on pedestals high above the sidewalks, the signs display different inscriptions in each direction. The boxlike frames are painted with large letters on white background, and the picture of a skeleton is vividly shown pointing into the crowds, or indicating the path of passing vehicles. Of 713 deaths due to street accidents in Chicago in 1923, it has been shown, 115 were caused in attempts to pass through moving traffic, while 296 persons lost their lives in efforts to cross busy streets midway in the blocks. It is believed that by spreading the messages of safety by means of silent "missionaries," people can be induced to use more care.

© Keystone

Death Sign Installed at Street Corner to Warn Jay Walkers and Motorists of Carelessness

Time and Money-Saving Tools

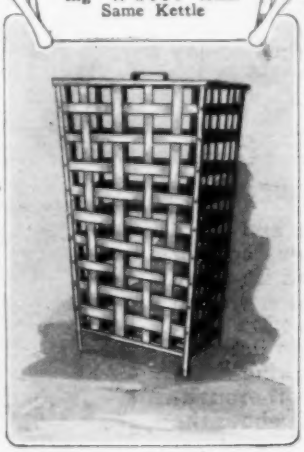
Spring Brace under Chair Seat for Raising Sunken Bottom

Ventilated Electric Iron Is White and Keeps Handle Cool

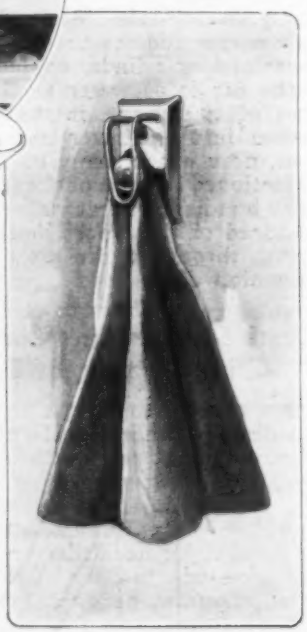
Electric-Iron Cord Carrier Prevents Kinks and Twists

Hot Plates and Boiling Water from Same Kettle

Grip for Lifting Fruit Jars Saves Burning Fingers and Will Not Slip



Woven-Steel Refuse Burner Can Be Folded Flat When Not Used



Spring Wall Holder for Dish or Dust Rags Prevents Tearing Cloth

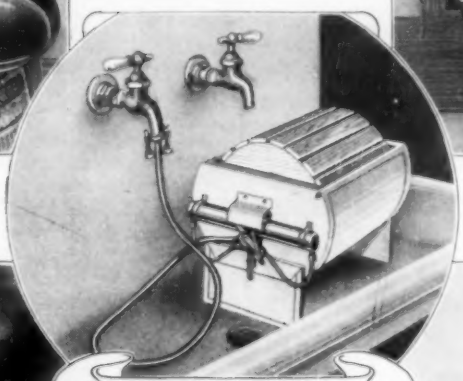
Anyone wishing further information on devices described in the editorial pages can

for Woman's Workshop in Home

Divided Frying Pan Saves Gas and Cooks Two Dishes

Condensed-Milk-Can Punch Also Seals Holes from Dirt

Safety Window Opens Inward and Slides Up or Down



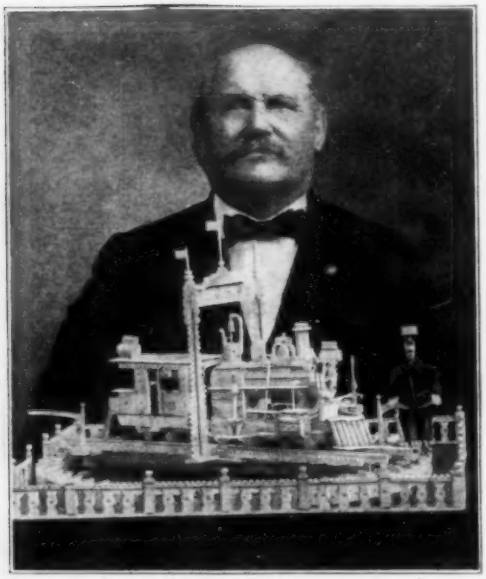
Tiny Water-Power Washing Machine Works in Sink

Slicer Cuts Beans and Other Vegetables into Narrow Strips

Bread Is Cut Thin and Even Easily in This Wire Guard

This Screw-Cap Egg Beater Fits Both Pint and Quart Jars

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.



Skilled Carver and a Few of the Articles He Has Shaped from Bone

Carver Spends Twenty-Four Years Shaping Wonders from Bone

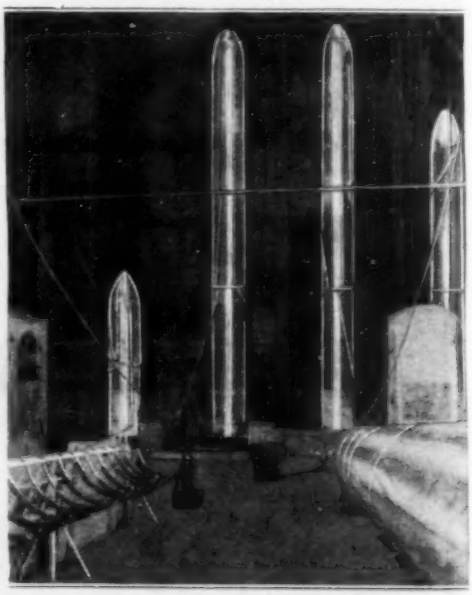
More than 70,000 hours, or the equivalent to twenty-four years of eight-hour working days, it is estimated, have been spent by Conrad Grasshoff of Altamont, Ill., in carving objects from bone. A veteran of the Civil War, he began carving in 1872 and spent years in making a model of a church with the preacher and sixteen worshipers inside. In all he has carved sixty human figures, even the fingers being carefully filed apart, and in nearly every case the individual is holding an article. In making a miniature house, it took three months to carve the pickets in the fence and weeks were needed to make the representations of shrubbery and flowers. A ferris wheel is complete to the most minute detail; the wheel revolves and the cars with the occupants fall into proper place. The mechanical parts of the engine can also be operated.

Iron Fed Pineapples through Leaves Saves Planters Millions

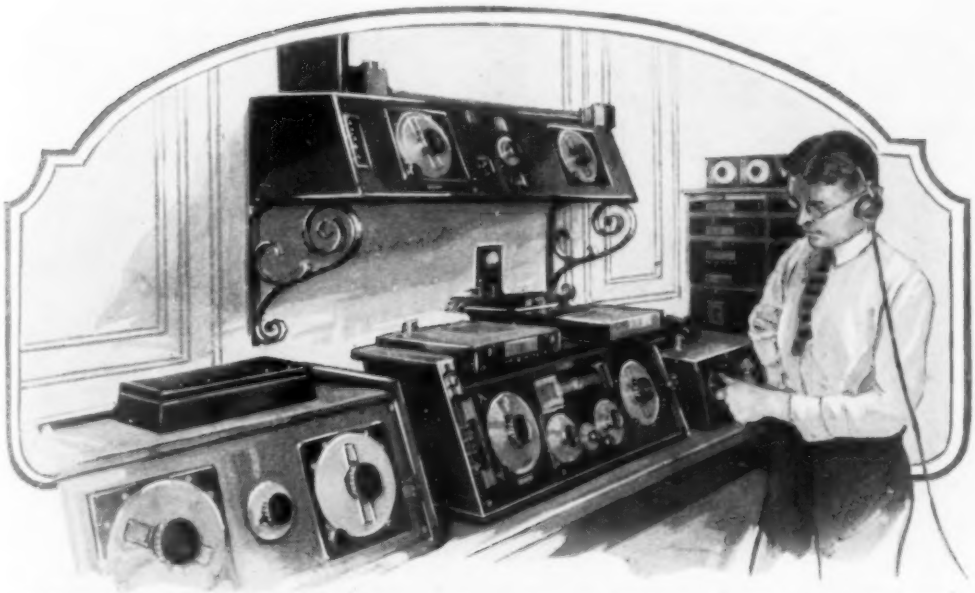
By feeding a solution of iron sulphate to pineapple plants through the leaves, growers have succeeded in increasing crop values by many millions of dollars. Attempts to better the quality of the growths by applying the material to the roots were found to be almost entirely ineffective and the spraying process was resorted to after investigations on plantations of Porto Rico. Although the addition of 3,000 pounds of iron sulphate a year to an acre of soil in Hawaii showed no results in the crops, a supply of fifty pounds deposited on the leaves of the pineapple plants during an equal period converted scanty growths to healthy vigorous crops. The iron mixture sprayed on bushes and grasses of pasture lands in New Zealand, where many sheep and cattle died from "bush sickness," eliminated such losses which were caused by the inability of the animals to get a proper supply of the mineral salts.

Plate Glass Blown in Tubes by Air Blast, Then Rolled into Sheets

Far too large for even the most skilled and powerful glass blower to handle, the gigantic cylinders, from which huge sheets of plate glass are cut, are blown by compressed air from molten masses placed over drum-shaped blowers in modern factories. Clamped in secure position, the tubes are pulled out steadily as they distend to prevent bulbous shapes, the blowpipe is withdrawn gradually and the amount of air regulated carefully to insure an even "growth" of the tremendous cylinder. When they are distended to the desired height and thickness, the tubes are cut, heated and rolled out into flat sheets.



Blowing Cylinders of Glass with Compressed Air; Racks for Finished Tubes in Foreground



Receiving Apparatus of the Great Radio Station at Nauen, Germany, One of the Most Powerful in the World, Where Germany's Naval and Commercial Wireless Traffic Is Hand'ed

Girdling the Earth by Radio

Nations Linked by Giant Stations Which Hurl Messages Back and Forth across the Seas with the Speed of Light

BOY scouts assembled recently in the auditorium of a New York public school dispatched a message to Sir Baden-Powell, England's boy-scout master. Twelve minutes later the answer had come back from London and was being read to the boys. The delay was due to the time it took General Baden-Powell to read the message and write his answer. The actual transmission time for the entire radiogram was less than a minute from New York to London and less than a minute to come back. Far up over the wave length of your radio receiving set, the ether is constantly filled with a multitude of busy dots and dashes, tiny streams of electromagnetic waves being sent hither and thither on the world's business. To the average person with a radio outfit designed for receiving short-wave broadcasts, these troops of unseen dots and dashes remain unheard because of the long wave on which they travel, and because they are both unseen and unheard, the romance of their being remains little known.

But go to any telegraph station any place in America and you can dispatch a radio message across the seas to most any civilized land. By land wires from your town to some spot on the Atlantic or the Pacific coast, your message will go as a telegram, and there, in virtually no more time than it takes to tell of it, the telegram will spring off into space to come down again at its destination, whether that be some place in Europe, in South America, Hawaii, the Philippines, Japan or Asia.

Simple enough in the telling, but the machine that sends the electrons catapulting off into space requires a vast organization, immense areas of ground, enormously tall, slender steel masts, miles upon miles of aerial wires and ground connections, huge power houses and great cooling ponds to chill the water that circulates through the high-speed alternators to insure constant mechanical operation.

Out on Long Island, seventy miles from New York city, is one of the greatest of all commercial broadcasting stations, which is known to the world as Radio Central. Sixteen miles away is its companion receiving station. The one sends out messages to all the world and the other brings back the answers, each working independently and without interference

Sending Operators Punching Messages in Transmitting Tapes at Rate of 100 Words a Minute for Each Machine; Below, Radio Central, Covering Ten Square Miles, as It Will Look When All Twelve Antennas, Each Mile and a Half Long, Have Been Completed

Messages from Overseas Being Copied Direct from Tape Recorder onto Message Blanks in New York, and, Left, One Switchboard in the 300,000-Watt, 20,000-Meter Station at Nauen

Receiving Room in Berlin Where Messages from America Are Copied

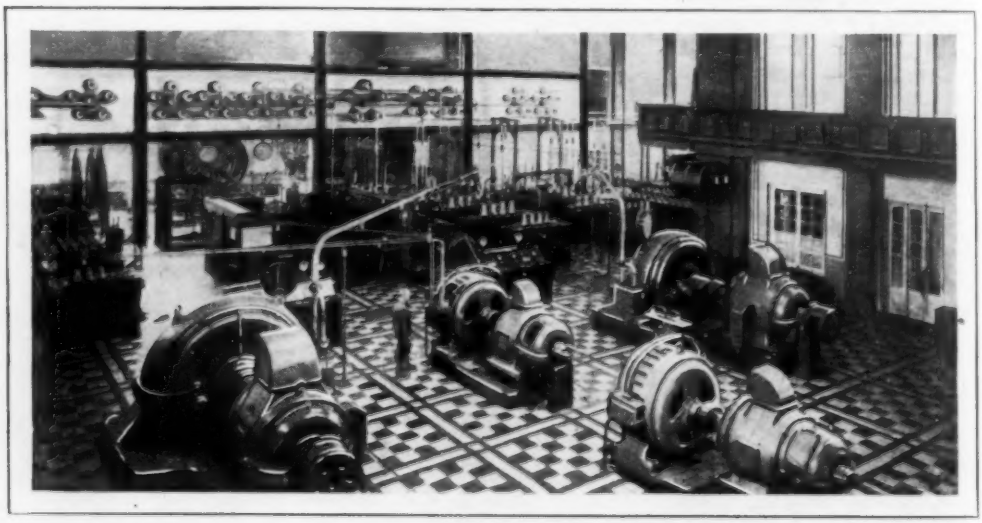
from or with the other. Back in New York is the brains of both stations. There, in an office on Broad street, are the operators who send and receive. They are connected with the transmitting and receiving sets by land wires.

The transmitting set at Radio Central will, when completed, include twelve great aerials, each a mile and a half in length, radiating from the power station like the spokes of a wheel. Two of the aerial lines, with a total length from end to end of three miles, are already in operation. Each of the twelve antennas will communicate with a different portion of the globe and each will have a capacity, day and night throughout the year, of 100 words a minute. Three of the aerials are to be set aside for communication with the countries of South America, three for trans-Pacific telegraph and radio telephone to Europe; while of the other six one will serve Poland, the next Denmark, a third Sweden, the fourth Germany, the fifth France and the last England.

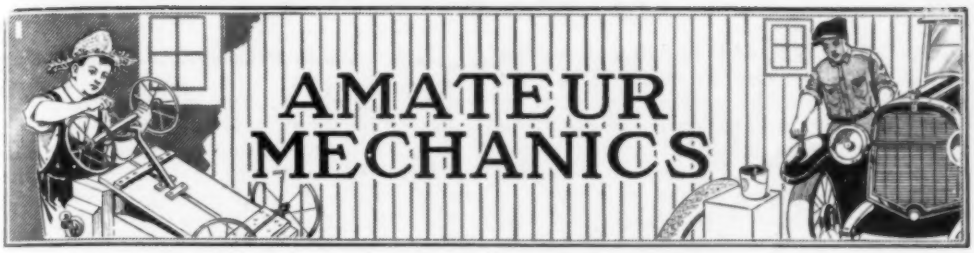
Each of the aerials is supported on six lofty towers, 410 feet in height, with a 150-foot crossarm at the top to carry the antenna wires. The towers are spaced 1,250 feet apart. The antenna itself consists of sixteen bronze cables, each three-eighths of an inch in diameter. Fifty miles of the cable were used in the two aerials already completed and 250 miles more will be needed to complete the installation. The ground connections for the two aerials now in use comprise 450 miles of copper wire, buried in starfish and gridiron pattern. The huge plant will, when finished, cover 6,400 acres, or ten square miles. Enormous quantities of steel and cement are going into its construction. The twelve completed towers of the first two aerials used 1,800 tons of steel, with 8,200 tons of concrete for foundations.

The range of the super-station is practically world-wide. Its signals are heard in Europe, Australia, South America and Japan. While no operators are used at the station itself, every message being handled from New York by the remote-control system, an engineer with a staff of fifteen assistants is required to look after the apparatus. A 23,000-volt transmission line from a town seven miles away brings power to the scene, while the ten high-frequency alternators of the completed station will give a power output of 2,000 kilowatts.

The transmitting rate of 100 words a minute is far above the speed of the fastest telegraph operator using an old-fashioned hand key, and is made possible by the use of typewriter sending machines. The operator writes his message on a typewriter keyboard, but instead of being printed on paper it is punched in a moving tape in the form of combinations of holes which constitute the code. As the moving tape passes along, electrical fingers establish contacts through the holes and transmit the signals over the land wires to the sending station, seventy miles away, where they are automatically relayed into the air. The receiving station, with nine individual circuits ready, is no less marvelous.



Generating Plant of the Huge Wireless Station at Nauen, Where 1,060 Kilowatts Are Generated as Compared to America's One-Kilowatt, or Less, Broadcasting Stations

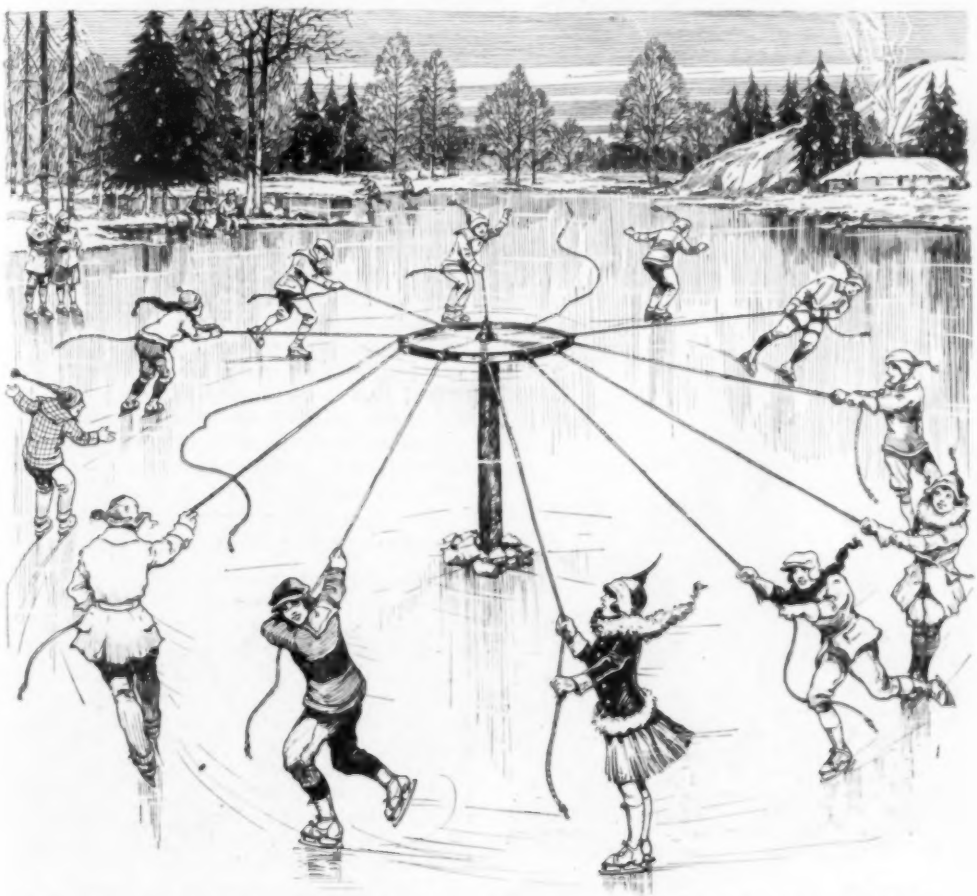


A Skating Whirligig

By G. E. VAN HORN

THE skating whirligig can be used in a number of different ways, and once it is set up in one corner of the lake or river, it will give sport to skaters throughout the season. It can be made from an old hayrake wheel, an iron rod about twice the length of the wheel hub, a long post and a length of rope, and with the help of three or four industrious friends, any boy can construct it in an hour.

The spot chosen for the device should be quite a distance from the bank, to permit skaters to whirl in a 40 or 50-ft. circle if they desire. Chop a hole in the ice slightly larger than the butt of the post and set the post in the mud on the bottom



A Long Post, an Iron Rod, an Old Hayrake Wheel and Some Rope Make a Whirligig That Provides Exhilarating Sport for the Skaters on the Pond

so that about 6 ft. of it remains above the ice. Throw the chunks of ice back into the hole around the post and allow it to freeze over again, later carrying away the remainder of the ice chips, which might trip the skaters. With a saw or plane, go around the top edge of the post, making a wide bevel. Now bore a 1-in. hole into the top end of the post for a distance of 12 or 14 in. Drive the 1-in. iron rod into the post, leaving about half the length of the rod exposed to view. Place a washer over the rod and oil it well. Then slip the rake wheel in place. Cut a number of ropes into 8 or 10-ft. lengths and tie them to the spokes of the wheel. Two long ropes may also be attached, each 20 or 30 ft., but they should be on opposite sides of the wheel. When the long ropes are used, they should be coiled up and held by the skater, later being slowly payed out as he skates about the whirligig until he is swinging in a large circle.

There are two general ways of using the device, one being to start from a standstill, with a skater on each rope. The skating becomes faster and faster until all are coasting while one or two continue to skate. Another way is to catch at the ropes while it is in motion. First, one skater heads for the ropes at full speed, grasps one of the ropes as he passes by, and starts whirling about. A second boy skates up and catches a rope, being careful to watch for a good opening. Another skater flashes in and takes possession of another rope, and this is continued until the whirligig is flying around at a fast clip. By tying a rope which is 75 or 100 ft. long to the wheel and having the others skate around it, one can slowly start a huge track about the wheel, and as the speed increases, it will be necessary to coast to keep one's balance. Then release the hold on the rope and sail off in a wide arc. One can find a dozen other different stunts.

An Outdoor Fireplace

A Wisconsin tinsmith has devised a neat outdoor fireplace for campers and tourists, which allows the full enjoyment of cooking over an open fireplace without annoyance from smoke. The draft caused by this device also aids in building a fire quickly. It consists of a length of 8-in. galvanized-iron pipe with a 24-in. cone at the bottom and a wind-vane elbow at the top. It is supported on a length of 1¼-in. pipe, a bolt through the top of the elbow providing a pivot upon which it may turn with the wind. Two doubled lengths of strap iron are riveted at either end of the pipe on the inside, to strengthen the stack and hold it in a vertical position without interfering with its operation, and these rest on washers pinned to the supporting pipe. The latter is driven into the ground inside of a short length of 3-in. pipe, and the space between the two is packed with soil or ashes. A double loop of strap iron is clamped to the top of the 3-in. pipe to hold cooking utensils.

Outdoor Fireplace Eliminates Annoyance from Smoke and Provides Grate over the Fire

Preventing Snow from Sticking to Shovel

It is usually somewhat difficult to use a metal shovel for scooping snow as the snow has a tendency to stick to it. This trouble can easily be prevented by first cleaning the shovel so that it is absolutely free from dirt, heating the metal part, and then covering it well with melted paraffin or wax. When the paraffin is cold, the shovel can be used, and it will be found that the snow will not stick. Of course, this will last only as long as there is a film of wax on the shovel, but it is surprising how long it takes before this film is worn off. Wooden shovels may be treated with grease or rubbed with soap.—Geo. E. Steinberg, Paonia, Colo.

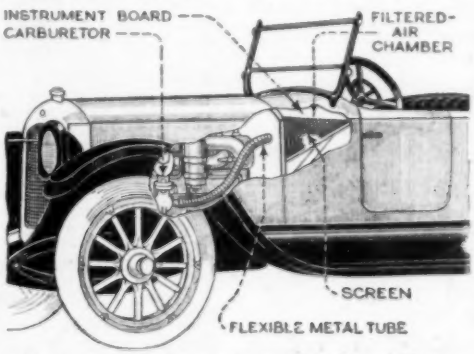
Novel Dog Wheel Chair

To eliminate the need for propelling his homemade wheel chair by hand, an ingenious cripple of Davenport, Wash., found it practical to use two dogs to push it. The vehicle was made from two ladies' bicycles with a comfortable kitchen chair arranged between and a sturdy frame to hold the parts together. A tongue with doubletree was arranged at the rear so that the two dogs could be harnessed to the car. While it was provided with a sprocket and chain so that it could be operated by hand, if necessary, the use of dog power proved more satisfactory.

Cripple's Novel Wheel Chair, Made from Ladies' Bicycles and Kitchen Chair, Pushed by a Dog Team

Air Filter for Carburetor

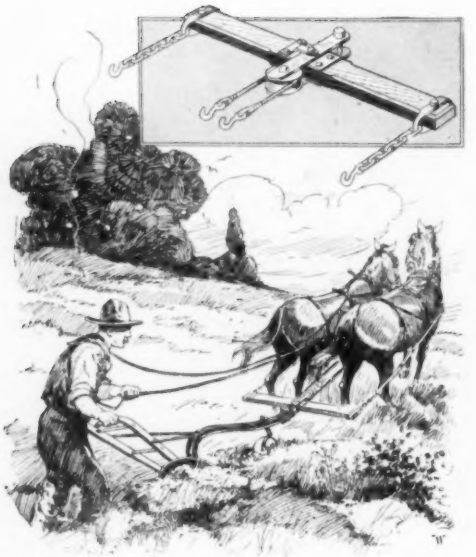
Analysis of the uncombustible deposit in the cylinders of an auto engine, after the carbon had been burned out, showed it to consist of ordinary sand, clay dust and limestone dust, which had undoubtedly been drawn into the motor through the carburetor. As the sand is highly abrasive, it is obviously responsible for most of the wear on pistons, rings and cylinder walls. The entrance of sand and dust into the carburetor air intake can be prevented by providing a filter of the kind shown in the drawing. This method has been tried out and found highly satisfactory. The space between the dash and instrument board was used as a filtered-air chamber and was connected to the carburetor air intake with a length of flexible metal tubing. This space was sealed to prevent air from coming in except through the filter, which was provided in the bottom. It consisted of several layers of closely woven cloth, with a piece of wire screen to make the filter more rigid. After a day's run a panful of dust was brushed from the underside of the filter. Later, when carbon was again burned out, there was no trace of any unburned deposit.—R. P. Cole, Paterson, N. J.



Air Filter on Carburetor Keeps Grit Out of Motor

Hints on Plaster Patching

If a large quantity of plaster of Paris is prepared at once, some of it may become hard before it can be used. To avoid this, mix it in a large shallow bowl, pouring only a little water at a time into the middle of the plaster and stirring it. As soon as this has been used up, repeat the process. If no plaster is at hand and one wishes to patch up holes or cracks, a good substitute can be made by using fine sand, 2 parts; fine ashes, 2 parts, and rye flour, 1 part. Mix with water to a consistency of a thick paste. This will become as hard as stone.



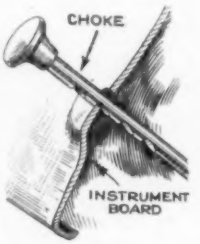
Two-Horse Evener Which Requires About Half as Much Space as the Ordinary Evener

Novel Two-Horse Evener

For breaking ground and cultivating in confined places the evener shown here will prove a boon to orchardists and road contractors as the space required for this evener is about half of that usually required, when two singletrees and a doubletree are used. A heavy pulley is attached to the center of a doubletree and a short length of stout rope, with the hooks securely fastened to the ends as shown, is provided on the pulley. The usual chains, with hooks attached, are provided on the ends.—J. T. Garver, Huntingdon, Tenn.

Carburetor Choke Adjustment

The carburetor choke on Ford cars is held by means of a spring which necessitates using one hand to keep it closed when starting. During cold weather it is often necessary to have the choke partly closed for some time, and it is then handy to have the pull rod stay in the position put. This can readily be done by filing a number of notches on the underside of the rod, as shown in the sketch, so that they will catch on the edge of the instrument board and keep the choke in any position. —C. W. Furay, Dayton, Ohio.

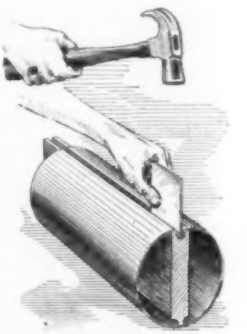


A Razor Kink

To the user of an old-fashioned razor who finds it a nuisance to take it to be honed, or too much trouble to do it himself, my method of keeping the tool in shape may prove of interest. I have kept my razor keen and sharp for a dozen years, by using a trace of flour of emery on one side of the strop. Merely dip one finger into the emery once or twice and rub it on. Start stropping on that side and finish on the other. When the razor gets a little out of condition do it again. No doubt the treatment will have to be varied a little with different razors, but three or four times a year is usually sufficient.—Chas. F. Goldthwait, Waterbury, Conn.

Reducing Diameter of Stovepipe

Sometimes it is necessary to reduce the diameter of a section of stovepipe when there is not a tinsmith in the neighborhood. However, this can readily be done by anyone at home with materials and tools available almost everywhere. A piece of tongue-and-grooved board, a little longer than the section of stovepipe, is obtained and stuck through the pipe as shown. By means of a piece of flat iron or steel, such as a discarded plane bit or a wide chisel with the edge dulled, and a hammer, the stovepipe is tapped down into the groove as shown in the drawing. The work must, of course, be done gradually from one end of the pipe to the other and the result will be a neat job. If a board of a width to produce the desired reduction in diameter is not at hand, one may be built up of two pieces and then trimmed down to the right size. —H. E. Gifford, Medford, Mass.



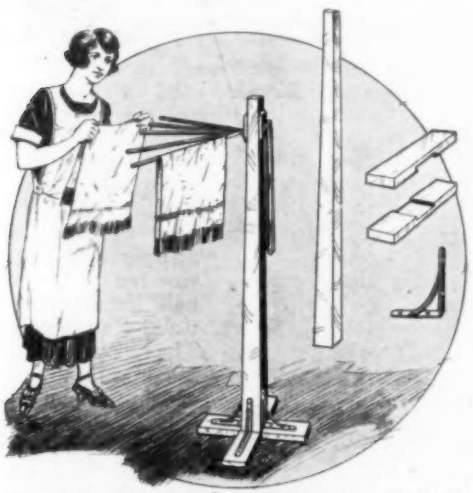
Substitute for Gasoline in Cleaning

Due to the inflammable quality of gasoline and benzine, carbon tetrachloride is far superior as a cleaning fluid for home use. It is a water-white fluid obtainable at any drug store and has no equal for removing spots or stains from any kind of fabric. Grease, paint, varnish, paraffin,

shellac, pitch and numerous other stains yield quickly to treatment with this fluid. It leaves no rings as gasoline and benzine do, and although it possesses a rather peculiar odor, no trace of it is noticeable after evaporation. Carbon tetrachloride does not attack the dye of any fabric and may be used for cleaning anything that can be cleaned with gasoline.—G. E. Hendrickson, Argyle, Wis.

Folding Clothes Drier

A neat, compact and serviceable clothes drier can easily be made from a discarded costumer. Remove the clothes hooks and fasten on either side a collapsible dish-towel rack, which can be bought at any hardware store. Lacking a costumer, the whole drier may be built as follows: Obtain a piece of wood from which can be made an upright 4½ ft. long, 2 in. square and tapered on two sides to the thickness of 1½ in. at the top. Dress down two pieces of 1⅛-in. material, about 16 in. long, and 3 in. wide, and notch them to form a base similar to those used for Christmas trees. The upright is braced to the base with four small shelf brackets obtained at a 5 and 10-cent store. Then the two towel racks are screwed on. A little wood stain, enamel and floor wax will dress up the wood and make a neater-appearing job. When opened, this clothes drier will accommodate a surprising number of articles, and when closed, it can be

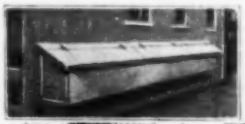


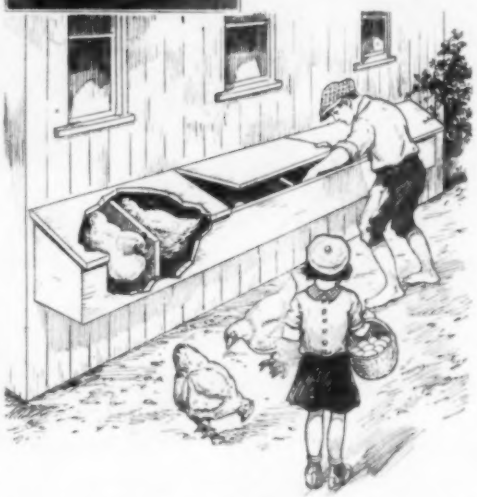
Neat Collapsible Clothes Drier Made from Discarded Costumer

stowed out of the way in any convenient corner or closet.—Bjorn Winger, Indianapolis, Ind.

Outside Nests for Poultry House

By providing nests on the wall of a poultry house, which enables the hens to reach them conveniently from the inside and permits the eggs to be gathered from the outside, the hens occupying nests





Outside Nests on Poultry House Are Convenient for Gathering Eggs

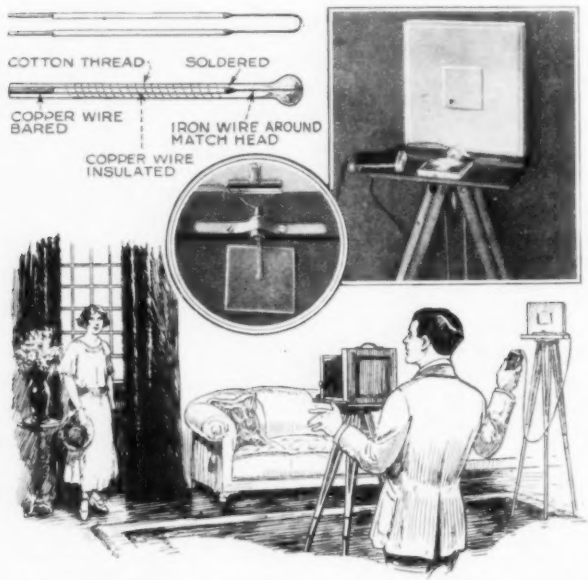
will not be frightened, with the result that they lay eggs in some unknown place. The box containing the nests should be about 14 in. wide. The nests are separated by partitions, as shown, and fitted with hinged lids covering two nests each, so that the empty ones can be reached without disturbing fowls sitting in the others. The lid should be lifted only high enough to admit the hand.—Dale R. Van Horn, Walton, Nebr.

Cork Plugs for Drafting Board

Draftsmen, whose work demands the use of paper of uniform size, sometimes experience difficulty in fixing thumbtacks solidly to the board due to the great number of holes already made in the board at that spot. The difficulty can be overcome, however, by using cork plugs, which can be replaced by new ones when worn out. At the four points where the tacks are generally placed, 1-in. holes are drilled through the board. Corks, large enough to make a snug fit, are forced into these holes and the projecting ends trimmed off flush with the surface of the board.

A Safe Flash-Powder Igniter

Accidents caused by careless firing of flash powder in taking interior photographs are still far from uncommon, although they all belong in the preventable class. A safe igniter, easily made from simple materials, is illustrated in the photos and detail drawing. Its essential parts are an ordinary safety match, a piece of thin iron wire, two pieces of insulated copper wire and a pocket flashlamp. The copper wires are stripped for a short distance at one end and the iron wire soldered to the opposite ends. This combination is doubled over the match so that the iron wire comes across the head, whereupon the copper pieces are pulled tight along the sides of the match and tied to it with a thread. The bared ends are connected, by means of a flexible lamp cord, to the poles of a pocket-flashlight battery. The match may be mounted in a small lamp socket and strapped to a board as shown, and a piece of glass or tile pushed under it to receive the flash powder. This is laid on and around the match head, and the complete assembly may be mounted on a tripod, in which case the board should be fitted with a socket to take the tripod screw. In one of the photos, the igniter is shown so mounted with a square tin-can lid behind it to serve as a reflector. The lamp cord should be sufficiently long to enable the operator to stand out of possible reach of sparks, and the igniter should, of course, also be placed so that no sparks can hit any other person or the furnishings in the room. For the sake of increased safety, the battery should be taken out of its case before the powder is put on the glass or tile, and not replaced until immediately before the powder is to be ignited. Also, in order to protect the lamp socket in which the match is mounted from the flame of the explosion, it may be provided with a metal cap at the front end. This is drilled to permit the match to pass through, the hole, of course, being large enough to forestall all chances of short-circuiting.—C. A. Oldroyd, Barrow-in-Furness, Eng.



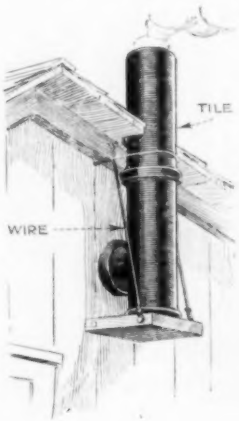
Safe Igniter for Flash Powder When Taking Interior Photographs

Banding Chinaware

A serviceable wheel for banding hand-painted chinaware is the turntable of a phonograph. Three old records are placed on the disk to bring the surface of the upper one slightly higher than the center pin. The piece of china to be banded is then set on the exact center of the top record, using the rings on the record as a guide. The brush can be rested on the tone arm of the machine. Care must, of course, be taken not to injure the phonograph.

A Good Farm-Shop Chimney

To lessen the fire hazard about his shop, a Nebraska farmer used a 6-in. tile for the outside chimney. The lower section has an opening on the side, in which the pipe fits, and is supported by a wooden block held by wires and nails as shown. The bottom is filled with concrete to a depth of 4 in. The upper section is cemented to the lower tile, wired to the wall, and extends well above the roof. For a building in which appearance is of secondary importance, this construction is excellent.



Making Useful Things from Leather Scraps

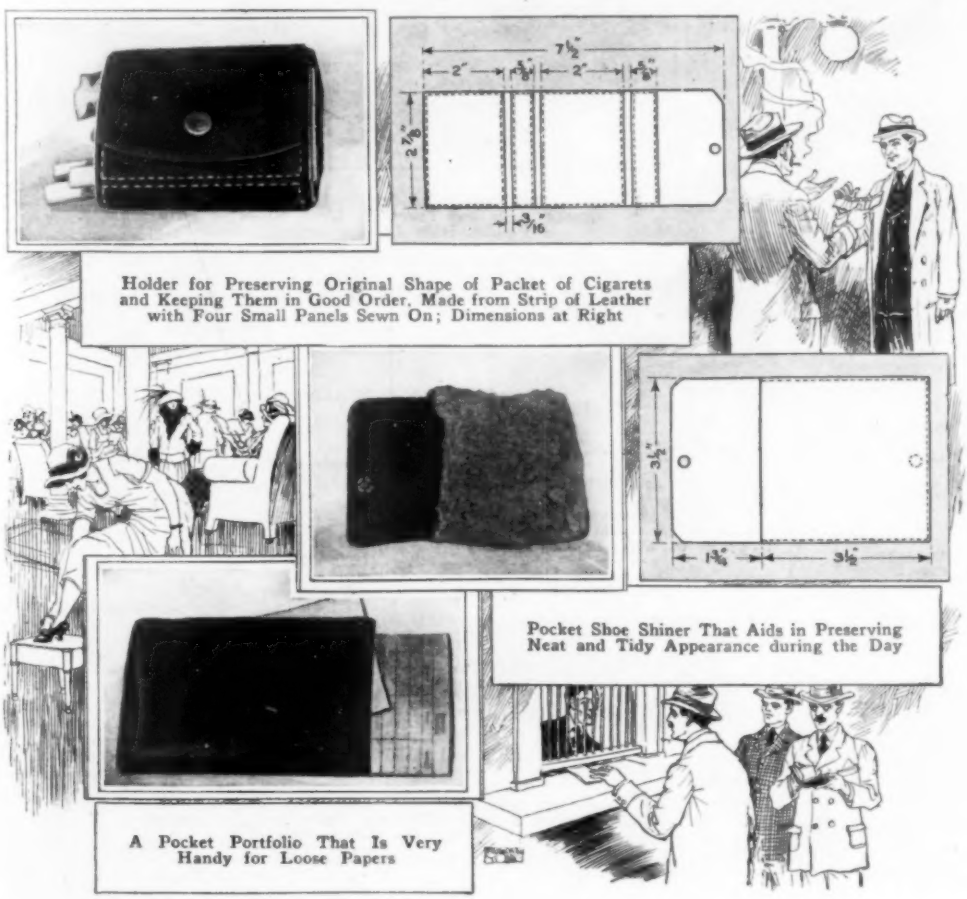
By EDWARD H. FLAHARTY

WITH some strips of scrap leather and lamb's hide, together with a little patience and ingenuity, a variety of novel and useful articles may be made. A number of these are shown in the accompanying illustrations. The first is a cigaret case. The usual packet of cigarets, when nearly exhausted, allows the remaining "smokes" to become crushed very easily. A pocket case remedies this, while not taking up much more space in the pocket than the original package, which it contains. It is made from a strip of flexible leather, 2⅞ in. wide and 7½ in. long, with four small panels of thin but stiff leather sewn to it at the points indicated, to correspond to the sides of the packet. A snap fastener keeps the case closed.

The pocket shoe shiner shown below this will prove a boon to the man or woman who likes to keep the shoes neat and clean. Carrying a rag for this purpose has sometimes been done, but the rag rapidly becomes so dusty and dirty that other things carried in the pocket become soiled also. This little shiner, on the other hand, is rolled up and snapped shut when in the pocket, and can do no harm. It is also made from a strip of leather, with a strip of lamb's hide sewed to the inside. The hide is sewed to the leather on three sides, leaving one end open, as shown, so that the shiner can be slipped over the fingers like a mitten when in use.

The next article shown is a pocket case for loose papers, letters, etc., and is very easy to make. The portfolio is open along the top, and part way down one side. It is 7 in. long and 4½ in. wide when finished, sewn across the bottom and 2 in. up one side.

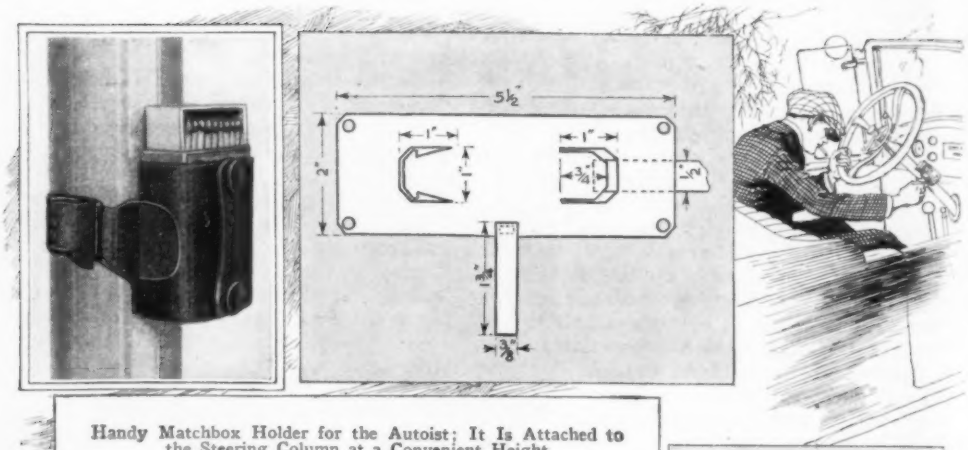
A steering-column matchbox holder is a very handy accessory for the motorist,



Holder for Preserving Original Shape of Packet of Cigarets and Keeping Them in Good Order, Made from Strip of Leather with Four Small Panels Sewn On; Dimensions at Right

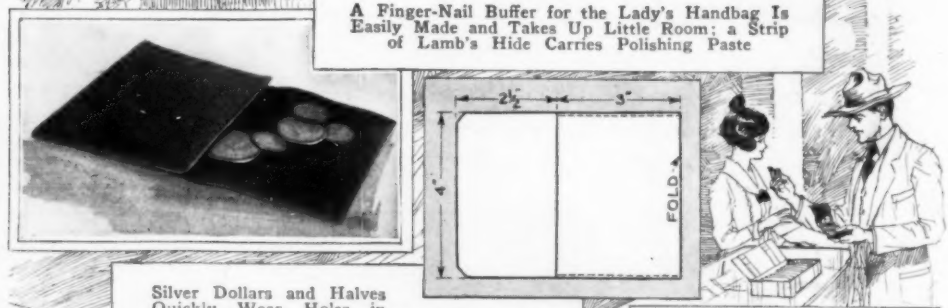
Pocket Shoe Shiner That Aids in Preserving Neat and Tidy Appearance during the Day

A Pocket Portfolio That Is Very Handy for Loose Papers

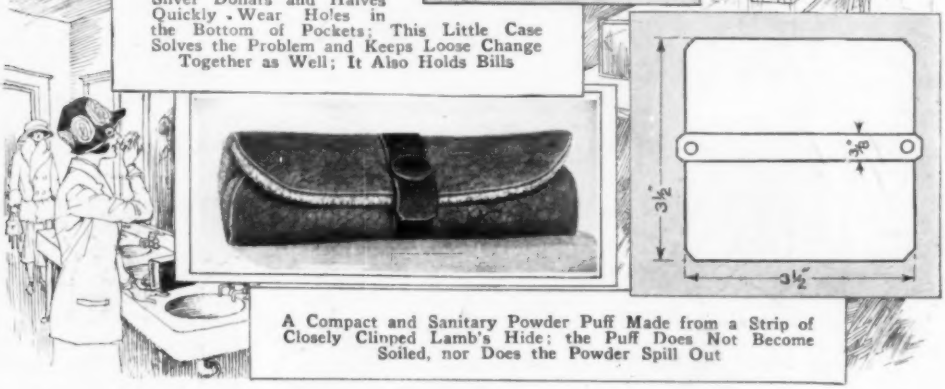


Handy Matchbox Holder for the Autoist; It Is Attached to the Steering Column at a Convenient Height

A Finger-Nail Buffer for the Lady's Handbag Is Easily Made and Takes Up Little Room; a Strip of Lamb's Hide Carries Polishing Paste



Silver Dollars and Halves Quickly Wear Holes in the Bottom of Pockets; This Little Case Solves the Problem and Keeps Loose Change Together as Well; It Also Holds Bills



A Compact and Sanitary Powder Puff Made from a Strip of Closely Clipped Lamb's Hide; the Puff Does Not Become Soiled, nor Does the Powder Spill Out

and the one shown in the illustration is an exceptionally neat one. The leather strip is 2 in. wide and 5½ in. long. Two sections are cut at each end, as shown in the detail drawing, to form ears for fastening the holder to the column. To one of the ears a strip of thin flexible leather, ½ in. wide, is sewn; this is cut long enough to pass around the steering column, and to the other end is attached a buckle. The other tab is cut so as to form ears that will catch in the buckle. Four snap fasteners, attached so as to hold the matchbox neatly, and a small strip of leather, sewed across the bottom of the holder to prevent the box from slipping through, complete the job.

The finger-nail buffer proves popular with the ladies, as it is very compact and takes up little space in the handbag. It is made by sewing a strip of the lamb's hide across the end of an oblong piece of light leather. The leather is 3 in. long, and the hide 2 in. long. The edge of the hide is sewed at a point 2 in. from one end of the leather. This allows 1 in. of the hide to overlap, and the overlapping piece is turned back and sewed on two edges, so as to form a pocket. The pocket is tightly stuffed with cotton wool and the remaining edge sewed. The back of the pocket is used as the buffer, and the polishing paste or powder is spread on the 1 in. of lamb's wool.

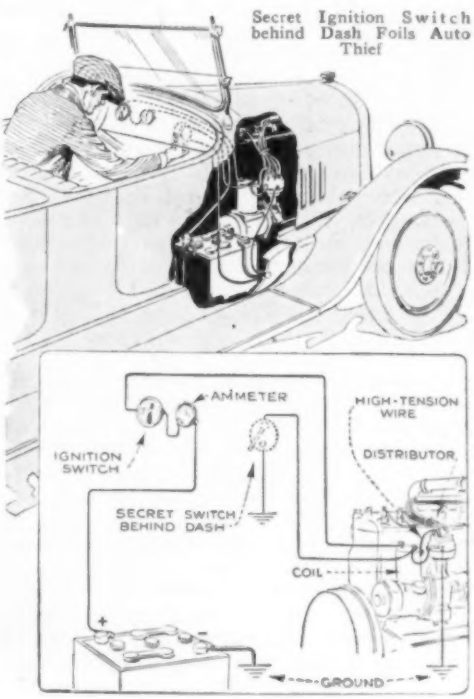
In the west and south, the silver dollar is very popular, but it quickly wears holes in the pockets, and the half-dollar is not far behind in this respect. The little coin case shown in the next illustration will effectively prevent this wear. It consists simply of a strip of fairly stiff leather, 4 in. wide and 8½ in. long. One end is folded so as to make a pocket 3 in. long and stitched on the sides. No snap fastener is needed with this case, as the folds can be made stiff enough to keep the case closed in the pocket. Bills may also be carried in this case, as it is wide enough to admit a roll of bills folded twice.

The last article shown is also a favorite with the ladies. It is a sanitary powder puff, made from a piece of lamb's hide, the wool of which has been clipped short. Dimensions are given at the right. A small leather strap is sewed to the back to form a support for the snap fastener. This puff rolls up and may be carried in the bag without becoming soiled and without losing any of the powder that is on it.

These are but a few of the many articles that can be made from scraps of leather and lamb's hide, but will serve to suggest a number of other possible uses for this material to the alert reader.

Secret Switch Prevents Auto Theft

With his snap-on jumper wire an auto thief can readily bridge the ignition wires of a car, when the switch is thrown off, and complete the circuit, which enables him to get away with the car. To prevent this many autoists have a secret ignition switch in addition to the regular one, but the auto thief, after first bridging the regular switch, notices that there is no discharge on the ammeter, which indicates an open circuit, and so he finds the second switch and bridges this one, too. However, the switch and connection shown in the drawing will foil the expert thief, as with this arrangement the correct discharge is shown on the ammeter after the regular switch has been bridged, but the coil is grounded so that the car cannot be operated. This is accomplished by mounting an extra switch behind the dash, of which one side is connected to the frame of the car and the other to the spark coil by carefully concealed wires. Ordinarily, when the car is running, this switch is open, but it is closed to make the ignition system theft-proof.—Richard P. Cole, Paterson, N. J.



Mail Box Opens at Both Ends

Constructed along lines entirely different from those of the ordinary mail box, the homemade one shown in the illustration is of unusual convenience, as the mail is dropped in at the top and removed at the bottom, and it provides sufficient space for fairly large packages, magazines, rolled-up newspapers, and the like. It consists of a sheet-metal shell, about 8 in. wide, 4 in. deep and 16 in. high, open at both ends. The edges of the metal are doubled over to prevent injury. The top and bottom, of 1-in. wood, are hinged to the wall on which the box is mounted and are held tightly against the openings by a heavy rubber band, cut from an old inner tube and attached to the inside of the top and bottom by means of hooks and screweyes, as shown. In use, the postman lifts the top and drops in the mail, while the owner removes it by pressing down the bottom as indicated.

Novel Mail Box with Hinged Top and Bottom Permits Easy Insertion and Removal of Mail

Silencing Automobile-Door Noises

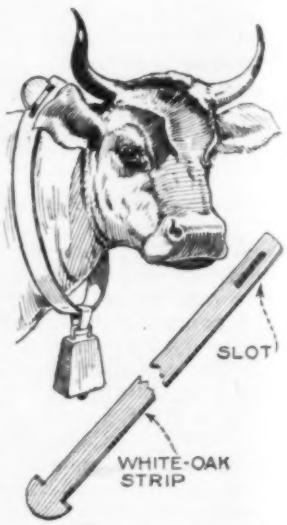
Squeaking automobile doors can sometimes be silenced by cleaning the rubber bumpers and the parts they touch with gasoline, wiping dry and powdering liberally with talc dust. Oil should never be used as it ruins the rubber. If the door rattles, see if the rubbers are pressing against the door. If not, readjust them with the setscrew, or by forcing small pieces of inner tube under them with a screwdriver. New bumpers may be needed. A few minutes' attention now and then will eliminate the annoyance.—Richard C. Tarr, Gloucester, Mass.

Repairing Stripped Thread

I was recently engaged in completing the inking-in of an extensive mechanical drawing. The work had entailed many curves, adjustments for the radii of which had caused frequent changes in my little bow-pen compass. When but a few minutes remained to complete the drawing, I found that the adjusting nut on the threaded shank of the compass refused to remain where placed. Seeing that the internal threads were worn, I went to the near-by machine shop, placed the nut in a vise and applied a moderate pressure so as to squeeze it to an oval shape. This changed also the shape of the hole in the nut, and the latter stuck on the shank.—Paul E. Garber, Washington, D. C.

Simple Cow Collar

Being a lumberman's daughter and interested in the use of wood for every possible purpose, I thought it worth while to pass along an idea I saw the other day—a wooden collar for a cow. The collar is really as simply made as can well be imagined. It consists of a strip of white oak of suitable width and length cut with the grain and planed down until it is quite flexible and can be bent in a circle. A slot is cut at one end so that the other rounded end can be slipped through it. The wood is bent around the cow's neck and will not come off readily because the twist in it will cause the strip to bind against the sides of the slot, holding the "head" at an angle to the latter.—Miss Reubena Potter, Aquene, N. C.



¶Chimney soot can be removed by throwing a handful of a mixture consisting of equal parts of sulphur and powdered saltpeter into the fire.

Unusual Newsboy's Vehicle

In a small mid-western town there is a crippled newsboy who found crutches too cumbersome, and therefore had a friend make the vehicle shown in the drawing and photograph. It is propelled by hand and steered by the feet, and was made from a girl's bicycle. The rear fork was spread about 6 in. to allow for the throw of the rear axle, which was made from a length of ¾-in. steel rod; the axle was about 30 in. long and had a 4-in. throw. It was run in four bearings made by filling 2-in. sections of 1-in. gas pipe with babbitt, drilled and reamed out to fit the axle snugly. Both rear wheels were rigidly mounted on the axle. An additional fork was made from ⅞ by 5/16-in. flat iron to brace the rear end and serve as a support for the seat, which was of special design. The wooden members of the frame and the movable parts were made of 1 by 1½-in. oak. The operating lever was about 40 in. long and was pivoted at the points indicated. The handles on this lever were made from two wooden doorstops, drilled and tapped so that they could be threaded on a ¼-in. iron bolt. The connecting rod was made of 1½ by 2-in. material. The handlebars of the bicycle were removed and a foot steering apparatus substituted. This consists of two flat-iron bars bent and attached to either side of the front axle, and connected to a pivoted steering board by means of ½-in. iron rods. A box was provided on the rear to hold the newspapers.—R. D. Sundberg, Rochester, Minn.

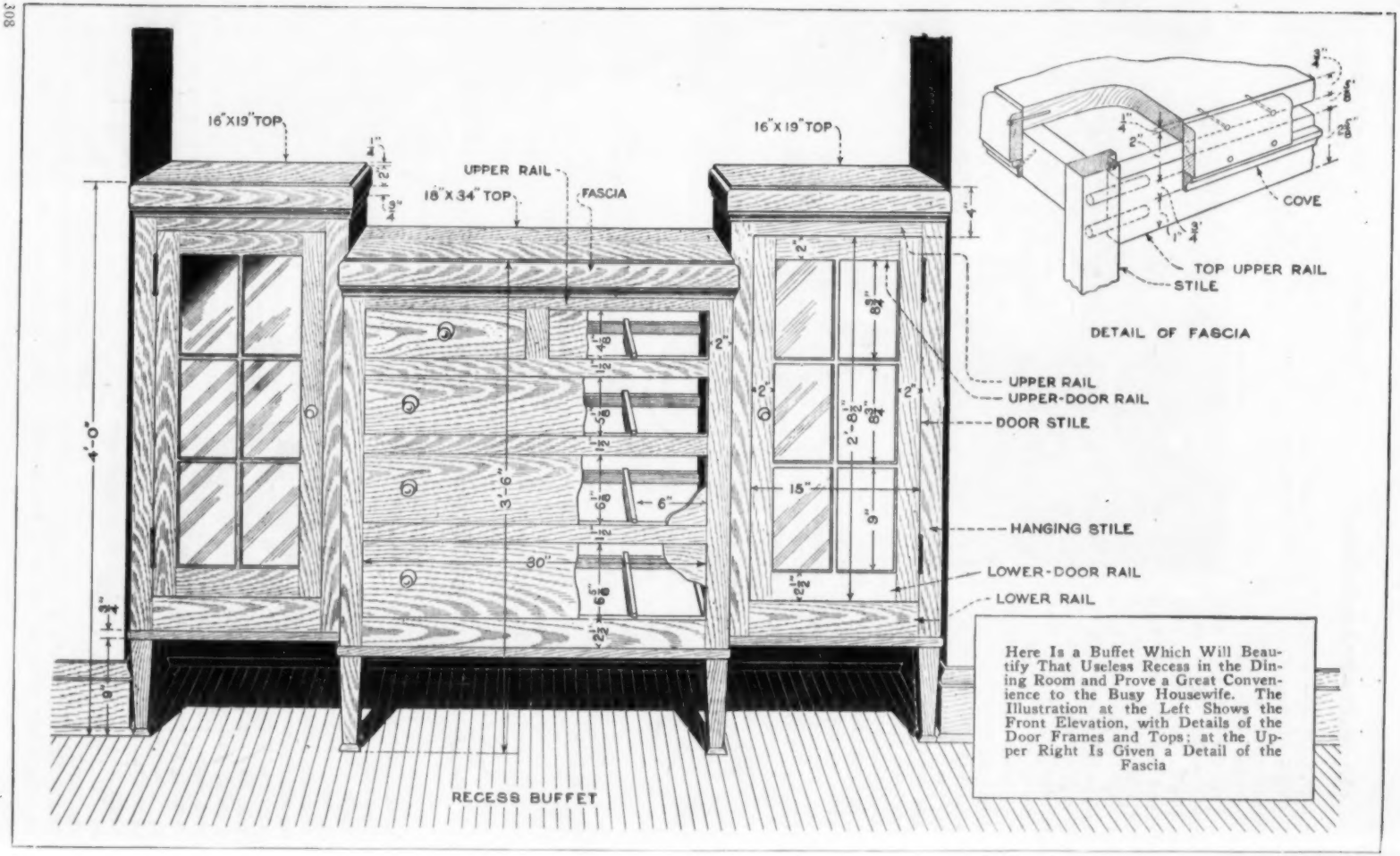
Newsboy's Unusual Three-Wheeled Vehicle Made from Old Bicycle; It Is Driven by Hand and Steered by Foot

Repair Link for Heavy Chains

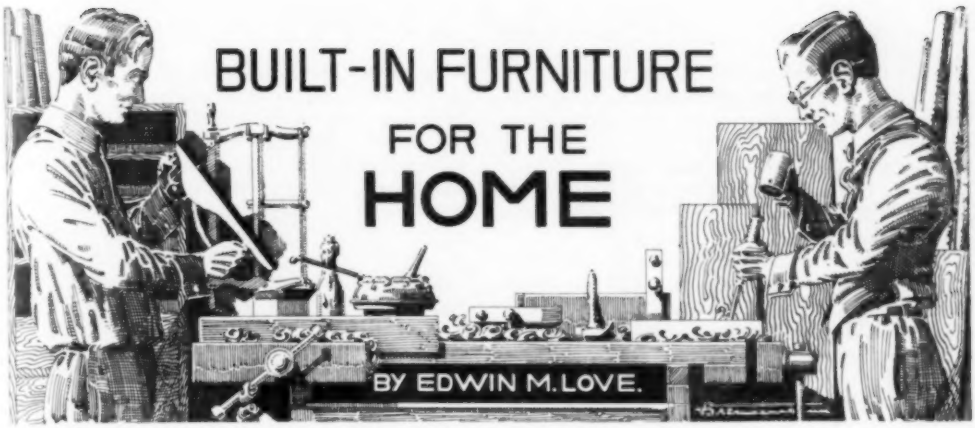
With his last split repair link in use a farmer found that he had no means for repairing a heavy chain, for which he had immediate need. However, he made an emergency "key-ring" link by clamping a solid link in the vise and splitting it with a hacksaw as shown. This permitted the two parts of the chain to be slipped on the link without much difficulty, using a hammer and chisel to wedge the parts of the split link apart. After the chain was repaired, the key ring was made solid by brazing.—James F. Hobart, Dunedin, Fla.

Designing Office Forms

When new forms have to be made for office or factory, much work with ruler and pencil can be avoided, and neater forms prepared for the guidance of the printer, if the first draft is laid out on suitable cross-section paper. If the squares are too prominent, turn the paper over and use the back. Lettering and ruling can then be sketched in quickly and easily. If blank spaces are later to be filled in with a typewriter, their length can be calculated on the basis of the space size of the typewriter, and there will be no troublesome adjustments to make during the writing.



Here Is a Buffet Which Will Beautify That Useless Recess in the Dining Room and Prove a Great Convenience to the Busy Housewife. The Illustration at the Left Shows the Front Elevation, with Details of the Door Frames and Tops; at the Upper Right Is Given a Detail of the Fascia



Part III—A Recess Buffet

MANY dining rooms are disfigured by projecting chimneys, or jogs from clothes closets. The recess buffet illustrated is designed to use and beautify the cubby holes formed by such projections; but the construction is such that, by the addition of end partitions, it can just as easily be built out into the room, using only the back wall for support. Again, a suitable recess might be made by building it into a clothes closet conveniently placed. As with the portable buffet described in Part II, its length may be increased or decreased to fit the space at hand, if care is used in proportioning the width of the drawer chest to the china closets. Using 1 by 10-in. stock, glue up the two partitions, which, when fitted in place, are 1 ft. 5 in. wide and 2 ft. 7½ in. long. Build the front frame for the drawer chest, using 1⅛-in. stock, with stiles and upper rail 2 in. net in width, the lower rail being 2½ in. wide, and the drawer rails 1½ in. wide. As the elevation shows, the upper-drawer space is 4⅛ in. wide; the next lower, 5⅛; the next 6¼, and the lowest 6⅝ in. Joints are united with two ⅜-in. hardwood dowels and glued. If possible, allow the frame to dry thoroughly in the clamps before removing. Clean off all trickles of glue while wet, and carefully surface the joints flat before placing the frame.

View of the Finished Buffet; This Job Is a Comparatively Simple One for the Amateur Craftsman

Although the exact heights for the upper edges of the wall cleats are given in the detail, it is well to use the front frame as a template in marking for the drawer cleats, since this takes care of any possible variations. Nail the cleats, of 1 by 2-in. stock, 2 ft. 8½ in. long, to the studding with eight-penny finish nails, guiding by pencil lines leveled across the wall, and keeping the ends plumb. Against these ends, tack the two wide partition boards, and block underneath to hold them steady. Hold a straightedge horizontally across the front edges to see that they line with the wall; and if they do not, make a suitable allowance in width. Variations in the plaster at the back make this precaution necessary. Try the front edges for plumbness, and if they lean forward or backward drop a plumb bob down from the top edge and mark suitable lines upon them, then dress or rip accordingly, beveling the edges inward a trifle to insure tight joints outside. Replace the partitions and nail solidly onto the ends of the cleats. Tack

a strip to the top and bottom to hold the front edges parallel, and brace temporarily. This done, nail up the china-case cleats according to dimensions given in the detail. Wedge the back cleats tightly between the side-wall plaster and the partitions. Level guide lines for the shelves on the partitions.

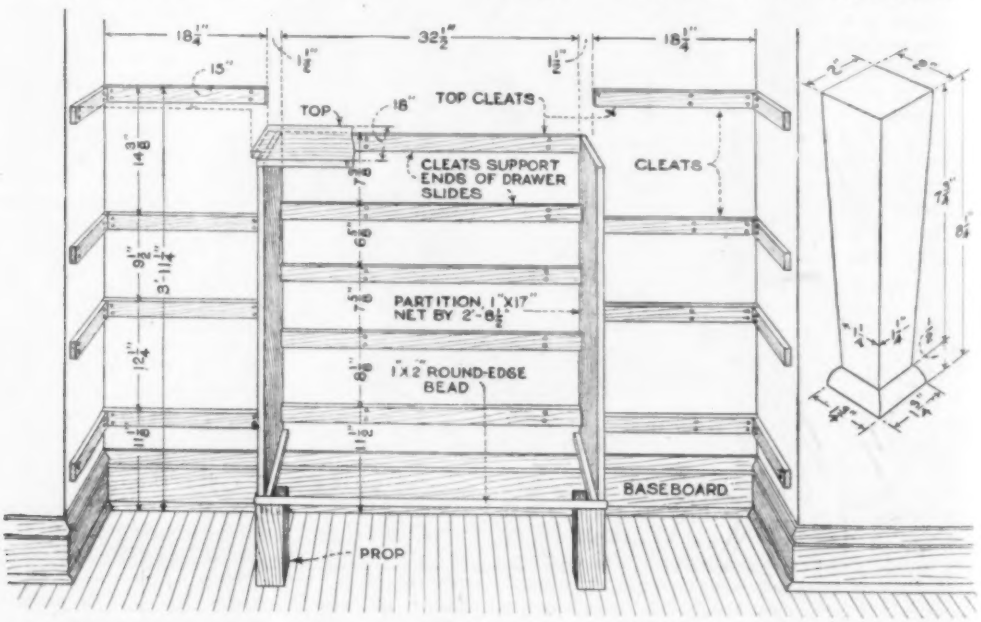
Glue up the shelves from 1 by 8-in. stock, making them 1 ft. 6¾ in. long. These will dry while other work on the cabinet is being done. Glue and nail the drawer-chest frame to the edges of the partitions. If a particularly good-looking joint is desired, leave the partitions 1 in. wider than called for, and miter the edges to the front frame. This makes a joint that is not quite so strong, but much neater.

Now build the two front frames of the china cases, making the stiles and upper rails of 1⅛ by 2-in. net pine, and the lower rails 1⅛ by 2½ in. net. While drying, fit the shelves in their spaces, either by cutting them ⅛ in. short and concealing the joints with ⅜-in. quarter-round molding (a rapid method), or by scribing and cutting close to the walls and partitions. Nail to the cleats and into the ends through the partitions. Take great care to keep the fronts plumb.

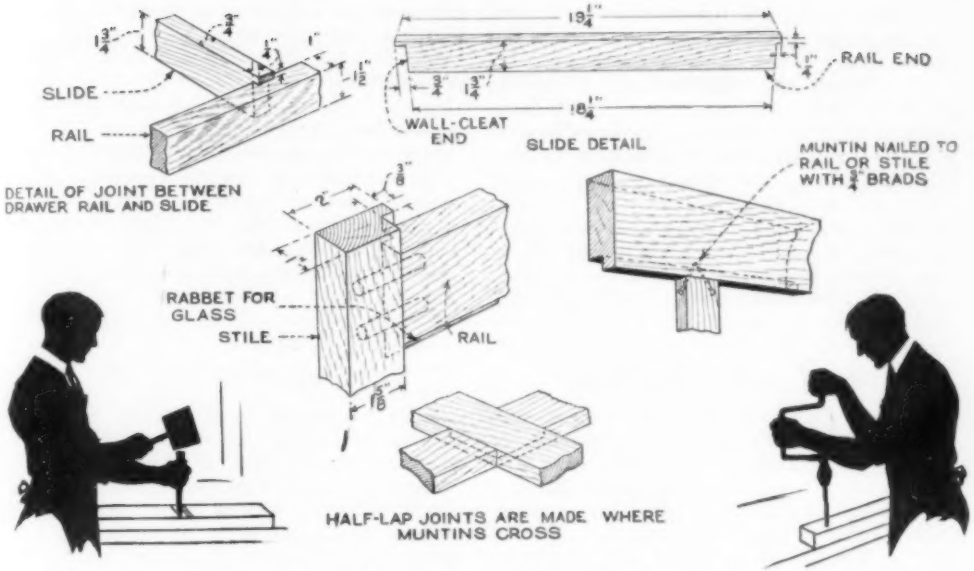
Fit the china-case frames against the partition and slip them back against the ends of the shelf cleats on the side walls. The lower shelf projects ⅜ in. above the lower rail, forming a stop for the door. The tops of both frames must be alined with each other, and the bottoms must line with the bottoms of the drawer frame and partitions, so that the 1 by 2-in. round-edge bead on the bottom can be mitered neatly. Glue up the tops, using 1 by 10-in. stock.

Build the doors of 1 by 2-in. net material for stiles and upper rails and 1⅛ by 3-in., sized to 2½ in. net, for the bottom rails. Cut the stiles 1 in. longer than the finished door and bore for the dowels before rabbeting for the glass molding. The ends of the rails must be carefully notched around in the stiles, as shown, after being bored for dowels. The bars or muntins are cut in between the flanges of the fronts of the doors, the joints at the crossings being half-lapped. This requires careful work, but skillful manipulation will cause the bars to spring inward slightly, so that when the glass is set they will bear tightly against it. Thus one sheet of glass only is necessary. In surfacing the doors, reduce the frame to 1/16 in. less in thickness than the hanging stiles, allowing clearance for easy closing.

While the detail of the drawer slides gives exact dimensions, in actual practice it will be found that irregularities in the plaster will necessitate changing their length. They should fit snugly, but care



Details of the Shelf and Drawer-Slide Cleats, Nailed to the Wall Studs; Partitions in Place Ready for the Frames, and Detail of Legs



Various Constructional Details; Joints of Drawer Rails and Slides, Door Stile and Rail Joints, Muntin Joints, and Cutting of Drawer Slides

must be taken to prevent them from springing the drawer rails outward. Frequent tests with a straightedge at this stage will eliminate much work in fitting the drawers. Put the guides 6 or 8 in. from the ends of the drawer openings, and those for the two small top drawers in the center of each space, keeping them level and square with the rails. Toenail the front ends from the back.

The front edges of the tops are flush with the front frames. Note that the ends of the drawer-chest top project behind the china-case stiles 1 in., forming a base upon which to support the short sides that project above the chest. If the cabinet is to be painted, these strips may be put in with the grain running horizontally; but if stained, the grain should be vertical. Miter the fascia, or nosing, around the tops, allowing a margin of ⅛ or ½ in. from the top—a very pleasing line—and fit the cove around underneath. Since the fascia is only ⅝ in. thick, and should project beyond the cove, the top of the latter is reduced to ⅜ in. in width, both by thinning the back and by removing stock from the front edge.

If it is desired to use three-ply panel veneer for the top, thus eliminating shrinking and warping, use plenty of cleats, carefully lined with each other, as backing, and show not more than a scant ⅛ in. margin above the fascia, if any at all, so as to hide the ply joints.

The legs are made of stock, 2 in. square

MATERIAL LIST

1 piece, 1⅛ by 3 in. by 8 ft., pine or fir, S4S, sanded.
3 pieces, 1⅛ by 2 in. net by 10 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 2 in. net by 10 ft., pine or fir, S4S, sanded.
3 pieces, 1 by 2 in. by 8 ft., pine or fir, S4S, sanded.
1 piece, 1 by 2 in. by 16 ft., pine or fir, S4S, sanded.
1 piece, 1 by 3 in. by 12 ft., pine or fir, S4S, sanded.
2 pieces, 1 by 8 in. by 10 ft., pine or fir, S4S, sanded.
2 pieces, 1 by 10 in. by 14 ft., pine or fir, S4S, sanded.
1 piece, ⅝ by 2 in. net by 10 ft., pine or fir, S4S, sanded.
1 piece, 1-in. cove, 10 ft. long.
1 piece, 1 by 2-in. round-edge bead, 10 ft. long.
2 pieces, ¾ by 18 in. by 7 ft., three-ply panel veneer (for veneer top).
1 piece, ⅜ in. net by ¾ in. net by 10 ft., pine, sanded (for muntins).
1 piece, 2 in. net by 2 in. net by 3 ft., pine (for legs).
1 piece, 1 by 5 in. by 3 ft., drawer front, pine.
1 piece, 1 by 6 in. by 3 ft., drawer front, pine.
1 piece, 1 by 7 in. by 3 ft., drawer front, pine.
1 piece, 1 by 8 in. by 3 ft., drawer front, pine.
Same lengths of ½-in. stock for drawer backs.
1 piece, ⅝ by 4 in. by 6 ft., drawer sides.
1 piece, ⅝ by 5 in. by 3 ft., drawer sides.
1 piece, ⅝ by 6 in. by 3 ft., drawer sides.
1 piece, ⅝ by 7 in. by 3 ft., drawer sides.
10 1¼-in. glass drawer pulls.
2 pairs 2½ by 2½-in. loose-pin butts to match other hinges in house.
2 sheets D. S. glass, 11⅝ in. by 2 ft. 4⅝ in.
2 frog catches.
1 lb. eight-penny finish nails.
1 lb. six-penny finish nails.
¼ lb. four-penny finish nails.
Cost of materials, about $16.
Time to build, about 36 hours.

net, tapered on the lower ends to 1¼ in. square, and fitted with hardwood feet, the grain of the latter running crosswise.

In making the drawers, allow ⅛ in. clearance for width and 1/16 in. in height, using a lip front; that is, the top edge and ends of the fronts are rabbeted to project over the rails and stiles, concealing the joint; this was detailed in Part I. Round off the corners for neatness. Guide strips nailed on the bottom, on each side of the slide, insure smooth drawer action. Tack a length of ⅜-in. quarter-round molding against the plaster at each end of the buffet to hide the joint between the stiles and the wall, and miter a 1 by 2-in. round-edge bead around the lower edges of the frames. Hang the doors with the hinges projecting in front about ½ in. Drill the holes for the knob bolts, and bore a ⅜-in. hole for the frog catch in the edge of each stile. Smooth the buffet thoroughly with fine sandpaper before finishing, bearing in mind that the least scratch or bruise will show plainly through the enamel or varnish.

Repairing Zinc Table Tops

Zinc tops on kitchen tables or cabinets sooner or later crack along the edge of a board that has warped. At the first sign of such damage, run a strong, sharp knife along the crack and slit the zinc so that the edges turn upward. Dress the edges of the cut down with a flat file and slip a narrow strip of tin under it, working it to the position indicated by the dotted lines, then flatten down the edges. Apply solder with an iron to sweat the tin and zinc together and to fill up the cut, and finally dress the projecting solder down with a flat file to make the surface smooth. Such a repair is almost unnoticeable and will be even stronger than the rest of the top.—Louis Schneider, Clinton, Mo.

Chart Record of the Garden

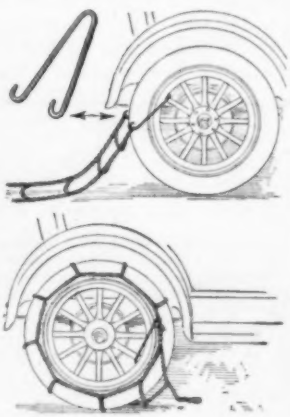
The home gardener often wishes to know what he planted last year and how it came out, but usually the facts are forgotten before the next season. The writer has tried a graphic scheme and found it quite practical. The rows are indicated on a piece of square-ruled paper, each space representing some convenient unit, such as 6 in. The variety of vegetable and date of planting are also recorded, and later in the season the degree of success is indicated.—Chas. F. Goldthwait, Waterbury, Conn.

How to Clean Jewels

The brilliance of diamonds, sapphires, rubies and emeralds can be restored if they are washed periodically in a little sal volatile and water, the surface being afterward polished with a clean chamois skin or a piece of soft silk. Precious stones in general are usually improved if they are put away in a box containing boxwood sawdust instead of being inclosed in velvet-lined cases. Coral can be successfully cleaned by placing it in boiling water and adding a few pieces of white soap and soda. Boil the coral a few moments, rinse in tepid water and dry on paper.

Hook for Applying Auto Chains

Auto chains can readily be applied with a hook of the kind shown in the illustration. The hook is made from a length of steel rod, bent as indicated. In use, it is placed over one of the wheel spokes and the second links of the chain are slipped over the bent ends, so that when the car is driven forward, the chain is pulled on the tire. Where the chain comes in contact with the road directly under the tire, the cross links retard the movement, while the hook pulls the chain taut. The first links are then fastened to the opposite ends of the chain, or if this is too loose, the second links are used after the hook has been removed.



Money-Saving Gas-Stove Hints

Simple Things That Help to Get the Most Out of the Stove and Heater without Danger to Health

THERE is a right and a wrong way to do everything, even such a simple thing as putting a kettle of water on the stove to boil. Experts say that very few stove users realize the utmost in service and economy that the stove is capable of giving. To get this utmost, the burners should be adjusted so that the flame is high enough to heat the vessel without licking its sides. The food should be ready for cooking before the gas is lighted, and the burner should be turned down immediately the water or food begins to boil. Permitting the contents to boil furiously does not hasten the cooking; it merely wastes gas. Lids should always be used on the pots where possible, as the food then cooks more quickly and gas is saved. Experiments show that cooking in open vessels consumes five times as much gas as in closed ones. When baking, put as many dishes in the oven at once as possible. Baking each dish separately is a waste in most cases.

The size of utensils has also much to do with the cost, ease and rapidity of cooking. The vessel should always be larger in diameter than the burner, so that most of the heat is concentrated under the pot. Also, there are three-in-one utensils in which three separate dishes can be cooked over one burner so as to save gas. In baking, aluminum, glass, or tin vessels give better results than enameled ware, although the latter is excellent for surface-burner cooking.

The oven must be kept free from rust. The door should be left open about half an hour after each baking, to allow the moisture to evaporate instead of con-

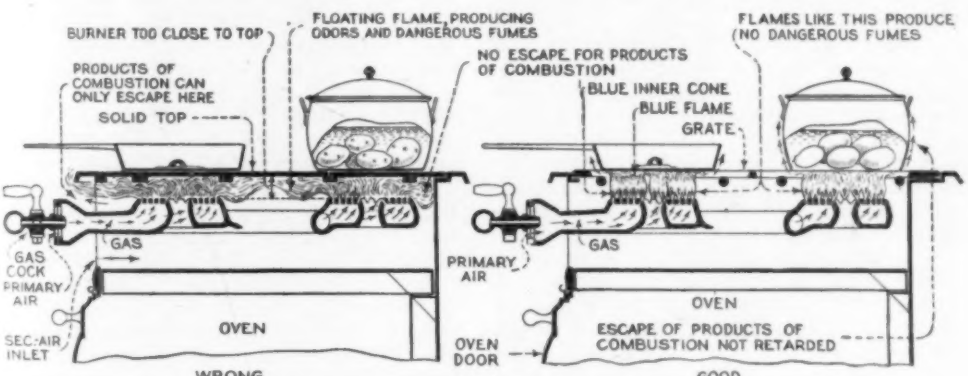


Fig. 1

Fig. 2

There Is Great Danger in Fitting a Solid Top on a Gas Stove Designed for a Grate Top. The Flame Caused by the Change Wastes Heat and Is Bad for Health

densing on the inside. Also, before starting to bake, light the burners, and open the door of the oven for a few minutes. This may seem a waste of gas, but it is not. Any moisture inside the oven will be quickly got rid of, and the practice will lengthen the life and improve the service of the stove.

The burners must be kept clean. This is very easy to do, and a smaller gas bill will soon be the result. Allowing vessels to boil over is one of the commonest causes of clogging the holes in the burner, and should be guarded against. When the burners do get dirty, boil them in a strong solution of lye or washing soda. Then rinse them thoroughly in clean water and set aside to dry. Don't forget to rinse the hands also after using the lye or soda, as these alkalis may hurt tender skins. The cleaning should be done periodically, for the time consumed in the job is more than regained by the saving in gas.

The prudent householder should make no changes in the stove himself, nor permit any self-styled expert to do so in order to "make it more economical." A stove should never be altered unless the local gas company has been first consulted and has approved of the changes, or it may become actually dangerous in more than one way.

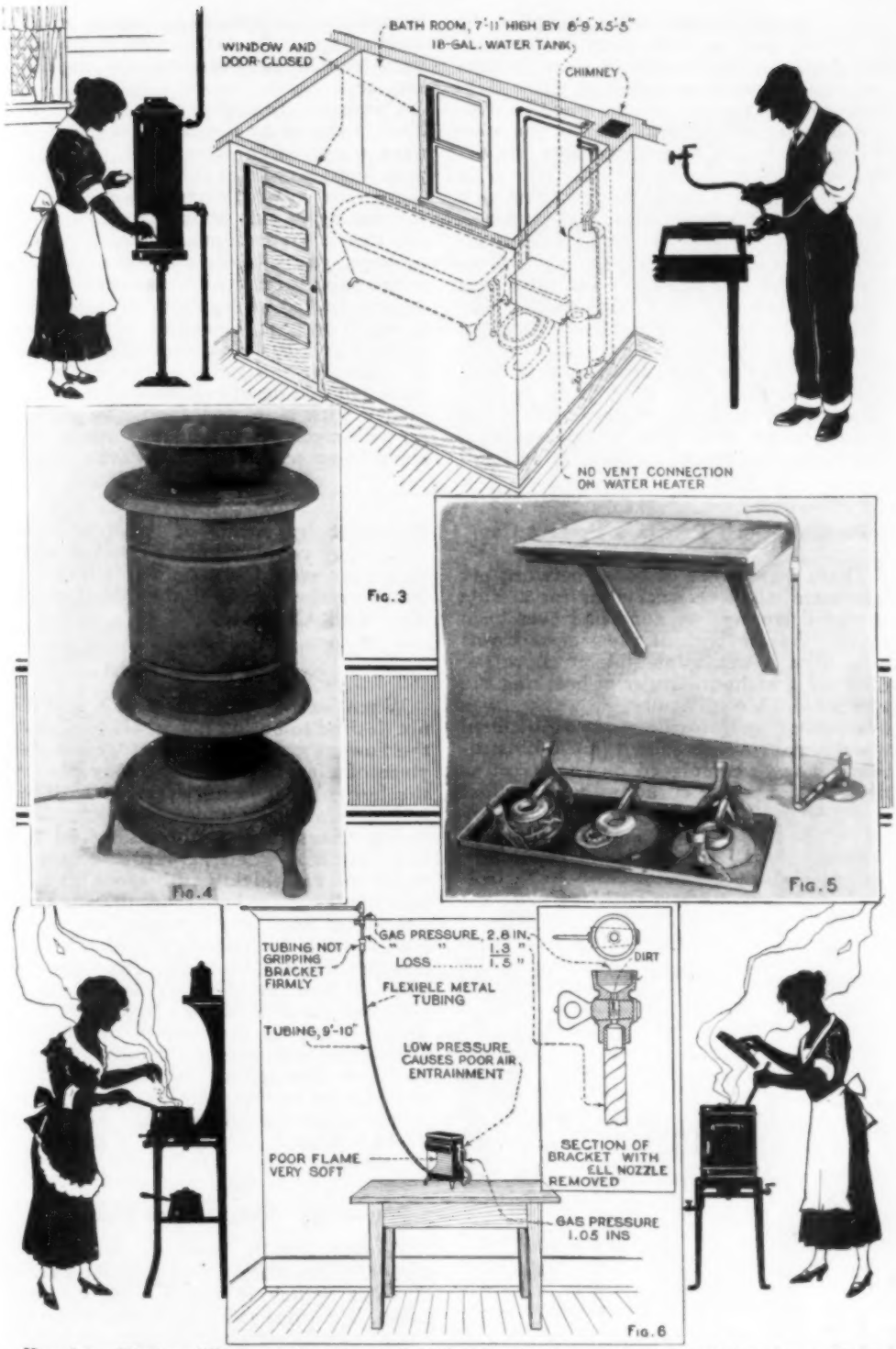
A common change made in gas stoves is that shown in Fig. 2. This stove originally had a grate top. The owner, however, was induced to equip it with a solid top, being led to believe that the latter was more efficient, and would not only aid in cooking meals quicker, but retain the heat longer and "concentrate" the heat of the individual burners under the cooking vessels. The result of the change was that the housewife began to suffer from headaches, nausea, fainting spells and similar ills, and this continued until the grate top was replaced, on the advice of the gas company. Fortunately this stove was used in a large kitchen, one door of which was always open, or the result might have been more serious.

The diagrams in Fig. 1 show what happens when a solid top is substituted for a grate top. For the proper combustion of the gas two supplies of air are necessary: the primary air, which enters the burner with the gas, and that which is drawn from the underside and the top of the burner; the latter is called the secondary air. With the solid top, the latter supply is cut down until there is not enough for complete combustion of the gas, and the result is a so-called "floating" flame, which produces an unpleasant odor and dangerous fumes. There is no escape for the products of combustion except through the front of the stove, under the top, and if a person stands there for any length of time, as is often necessary, the effect is soon felt. If all the burners are in use, the condition is, of course, aggravated, and the room becomes filled with the fumes. With the grate top, on the other hand, the escape of the products of combustion is not hindered; there is a plentiful supply of secondary air, and, provided the primary-air inlet at the cock is adjusted correctly, the flame is smokeless and odorless, and the food will be cooked quickly and without danger to the occupant of the room. The flame should be blue; if it is yellow, heat is being wasted and the gas company should be called upon immediately to adjust the burner.

Gas water heaters are also a potential source of danger, if improperly installed. Fig. 3 shows a bathroom in which a poorly adjusted water heater caused the partial asphyxiation of one person, and, but for the accidental discovery of the victim, might have led to his death. The heater was installed without a vent connection, and the window and door were both kept closed at all times. The water heater should never be in the bathroom, for if the doors and windows are kept closed, no matter how perfect its adjustment, it will consume much of the oxygen in the room, combustion will gradually become imperfect, and the person in the room may succumb to carbon-monoxide poisoning.

In Fig. 4 is shown a gas heater upon which someone had placed a basin of water. Whether this was done with the idea of supplying the necessary moisture to the air, or to heat water for some other purpose, the result was the same. The basin closed the vent holes in the top of the heater, thus restricting the supply of secondary air, and causing a floating flame, with its accompanying dangerous fumes. This led to a near-fatality also, although with the basin removed, the heater was perfectly safe.

A common method of installing a gas plate is shown in Fig. 5, in the condition in which it was found after an intoxicated person had stumbled against it and pulled it from the flimsy shelf on which it was placed. The man was dead when found. The plate was not screwed or clamped to the shelf; the tubing was old, there was no cock to cut off the supply of gas to the tubing and one connection was simply wrapped with a rag. This is an extremely poor installation, but there are thousands like it, each one a death trap.



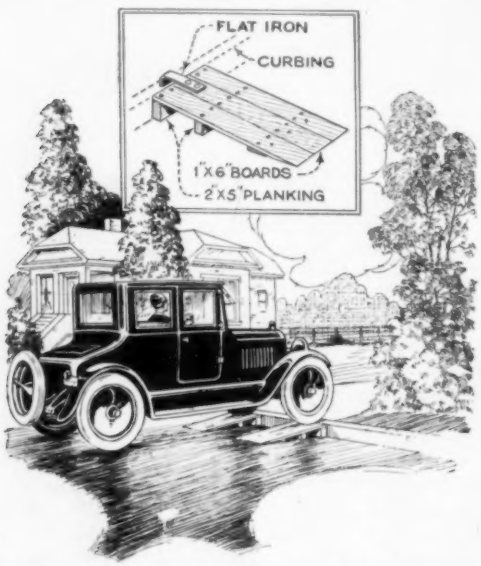
Here Are a Number of Dangerous Practices in Installing Gas Appliances. Good Installations Are as Easily Made as Poor Ones, and Are Not a Menace to Life and Health as Are Those Shown Here

Gas appliances are often installed by those not familiar with them in the manner shown in Fig. 6. This is not only dangerous, but very wasteful of gas. Gas-lighting fixtures are not designed to supply heating appliances, but in the case shown the long tube is attached to an ordinary gaslight bracket with the ell nozzle removed. The hole in the gaslight cock is too small for the job in the first place, and it takes very little dirt to stop it almost entirely. In this case the gas pressure at the line was 2.8 in.; the loss through the cock was 1.5 in., and the loss through the tubing .25 in., leaving only a pressure of 1.05 in. at the heater. This low pressure caused poor air entrainment, which resulted in a very "soft" yellow flame. Heaters of this type, and all other gas appliances, should be so installed that the amount of tubing required is as small as possible; in fact, if no tubing at all is used so much the better. Also, the cocks used should be designed for appliance service.

Cheap gas tubing is dear at any price. This is shown by the fact that 240 deaths have occurred in New York city in the past five years from this cause. The difference in cost between safe and dangerous tubing is only about 25 per cent, but the risk is tremendous. The foundation of good gas tubing is a jointless spiral metal tube, over which is a covering of rubber, coated with gelatin to make it impervious to gas. Over this is a wrapping of fiber, and, as a final protection, a braided cotton or silk jacket. The rubber end pieces should be of best quality, firmly attached with glue, and should be clamped on with metal ferrules if they are to withstand being pulled over gas cocks.

Portable Curb Runways Protect Car

There was plenty of room between my house and the one next door for a wide garage driveway but none had ever been made. As the curb at the sidewalk was 6 in. high it was impossible to drive the car over it without danger of breaking the springs. This difficulty, however, was overcome by providing two inclined wooden runways as shown in the illustration. They were placed on the street at right angles to the curb, and held against the latter by means of flat-iron hooks. Thus they could readily be picked up so that they would not be a hindrance to traffic on the street.—Robert H. Leitfred, New York City.



Inclined Wooden Runways Permit Autos to Run over High Curb

Keeping Plants Moist

When leaving home for a visit, and it is not desired to bother neighbors to care for the flowers, put all the pots together on a piece of tile in a cool and shady place in the house (if it is not freezing weather) and place a saucer under each pot. After giving the soil a good soaking so that some of the water runs into the saucers, cover the top thickly with moss, and the plants will not need water for quite a while.

Another good way is to put one end of a wick, made by braiding together several lengths of thick knitting yarn, in a pail of water and the other on the soil in the pot, near the root of the plant. The wick should reach to the bottom of the pail. The water will pass by capillary attraction from the pail and will supply plenty of moisture to the soil. Plants cared for in this manner will keep moist for several weeks.—Miss Z. I. Dahvice, Grand Rapids, Mich.

Preventing Vinegar from Darkening

Vinegar usually becomes darker with age. This moderate and gradual change in color, which it shares with all fruit juices, is natural and need cause no alarm. Sometimes, however, it becomes excessively dark, in fact almost black. This is

caused by the presence of tannin, which is a normal constituent of vinegar, and iron salts which have been introduced during the manufacturing process, and it is the chemical interaction of these two substances that produces the dark color. The discoloring can usually be eliminated by "fining" with gelatin in the following manner: Prepare a solution of ½ oz. of good edible gelatin by covering it with 1 qt. of water, allowing this to stand for some time, then heating until the gelatin is completely dissolved. This quantity is sufficient to treat a barrel of vinegar, into which it is thoroughly mixed by stirring. After a while the gelatin settles, leaving the vinegar clear. The clear liquid is then siphoned off and the remainder filtered to remove the sediment.

Winding Wall Clocks

Carrying a ladder to open, wind or set wall clocks in offices, stores or schools is a troublesome task that is made entirely unnecessary by the use of the simple device shown in the drawing. The key of the clock is soldered to a crank made of stout wire which is mounted through a hole drilled in the end of a long pole so that it can turn easily. A piece of flat steel is also fastened to the end of the pole and projects about 2 in. This piece is used to open the door of the clock and to set the hands; the key may then be inserted and the winding accomplished by the mere raising and lowering of the pole.

When making floating lids for developing tanks give them one or two coats of the varnish that is sold by sporting-goods stores for varnishing fishing rods. It is waterproof and is more convenient to use than paraffin.

Holder for Water Bottles

In many cities drinking water is bought in 5-gal. glass bottles and unless specially

Holder for Large Bottles of Drinking Water Facilitates Pouring

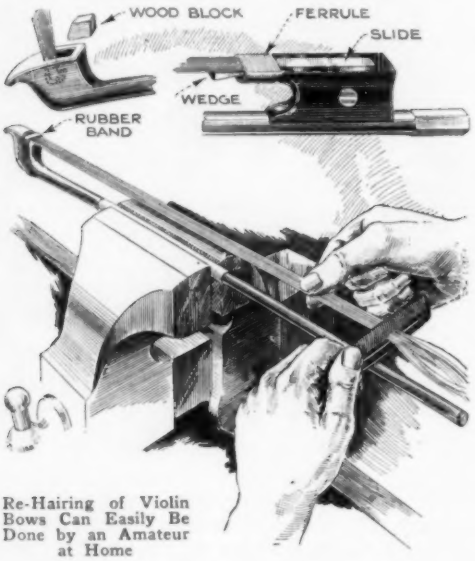
constructed stands are used to hold them, it is rather difficult to obtain water from them without spilling, as they are clumsy and quite heavy to handle, especially for women. A homemade holder, which eliminates this trouble, is shown in the drawing. One U-shaped piece of heavy flat iron and two rings of 1-in. band iron, are riveted together to form a snug-fitting receptacle for the bottle. This is in turn pivoted on a U-shaped support, of the same material as the other "U" and securely screwed to a wooden base. This arrangement permits the bottle to be swung over to pour the water out. The pivots should be located just above the center of the bottle's height, so that a child can readily tilt it.—V. S. Martin, Drumright, Oklahoma.

Measuring without a Rule

It is often necessary to measure some object or distance without a rule or tape. In cases where an error of 1/16 in. per foot is permissible, the following method can be resorted to: Take a silver dollar, and mark off eight diameters on a stick or piece of paper. As the diameter of a silver dollar is 1½ in., this distance will be very close to 12 in.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Re-Hairing a Violin Bow

Few violin students, or full-fledged players for that matter, know that the repairing of a bow of which the hair has become worn out is a job that they can do themselves, and well too. The writer has re-haired as many as seven bows in less than half a day, and has never had any trouble with any of them. New hair can



Re-Hairing of Violin Bows Can Easily Be Done by an Amateur at Home

be purchased at any music-supply house and, in smaller cities, usually at a drug store. It comes in rolls, each containing enough for one bow, and costs from 25 to 50 cents per roll.

The old hair is first cut off near each end and the small wooden block and hair from the hole in the tip, or nut, of the bow are removed with a pocketknife. The glue in the hole is then cleaned out with the point of the knife. The small wedge holding the hair and ferrule at the opposite, or frog, end of the bow is also carefully taken out, the ferrule pried off, and the pearl slide pulled out, taking care not to break it. It is then an easy matter to get the hair and glue out at this end. The bow is next placed in a small bench vise, as shown in the lower part of the drawing, a piece of paper or cloth being wrapped around the bow, to protect it from being marred by the vise jaws. The new hair is now unrolled, the knotted end held close to a lighted candle or match to melt the wax at this end, scorching the hair but not destroying the wrapping of thread. Cover the thread wrapping with glue and warm it by holding the candle or match close to it. Put about two drops of glue in the hole at the nut and place the hair in the hole. Spread the hair a little near the end by pinching it with the finger and thumb and force the wooden block down into the hole over the end of the hair, pushing it down flush with the tip so that the hair can be drawn over it smoothly. A rubber band is used to hold the hair in this position. The hair is now combed out straight with a fine-tooth comb, starting at the nut and working toward the frog from the underside. In doing this, follow the comb with the finger and thumb as indicated, holding the hair evenly and tightly. The frog is then loosened, by turning the hexagon nut at the end of the bow, and pushed as far forward as possible. Hold it in this position and pull the hair tight; then wind the hair with thread at the point directly over the hole in the frog and clip off the loose ends with a pair of scissors. Treat this end of the hair the same way as the hair at the nut, with glue and candle or matches, scorching the ends to form a knot. Put two or three drops of glue in the hole, slip the ferrule over the hair, place the end of the latter in the hole, and press the wooden block down so that the pearl slide can be pushed in over it. Then replace the ferrule on the end of the frog. Using the comb, straighten the hair and spread it evenly, and hold it securely in this spread position with the fingers while forcing the small wedge under it into the end of the ferrule. The hexagon at the end is then screwed up enough to take the slack out of the hair. There will be a few loose hairs, but these can be picked up with a pin and clipped off at each end of the bow. Loose hairs should never be pulled out of the bow as this may loosen some others. The bow is then hung up to dry overnight, after which resin is applied and it is ready for use.—F. J. Hiscock, Cody, Wyo.

Relining Ford Transmission Bands

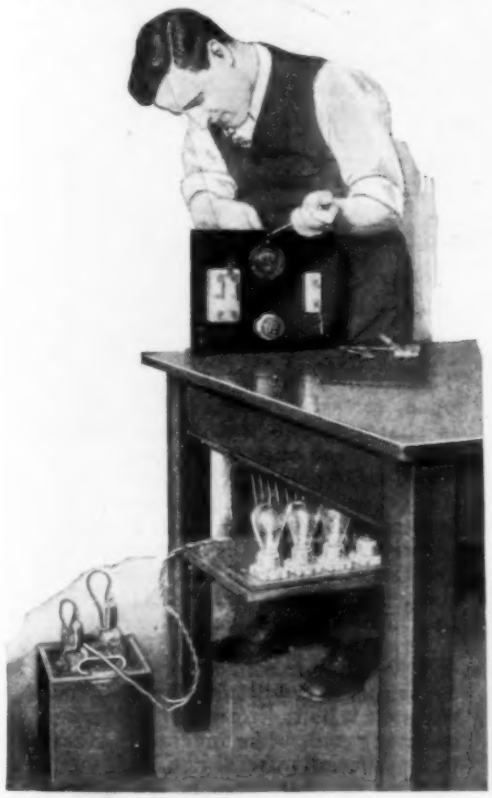
When relining Ford transmission bands it has been found advantageous to cut a piece out at the bottom as shown in the drawing. This permits the oil to work through the transmission, enabling the car to start more easily when cold and causing the grip band to work more freely. The lining is attached in the usual way and the piece cut out afterward.—A. Bronson, Argyle, Wis.

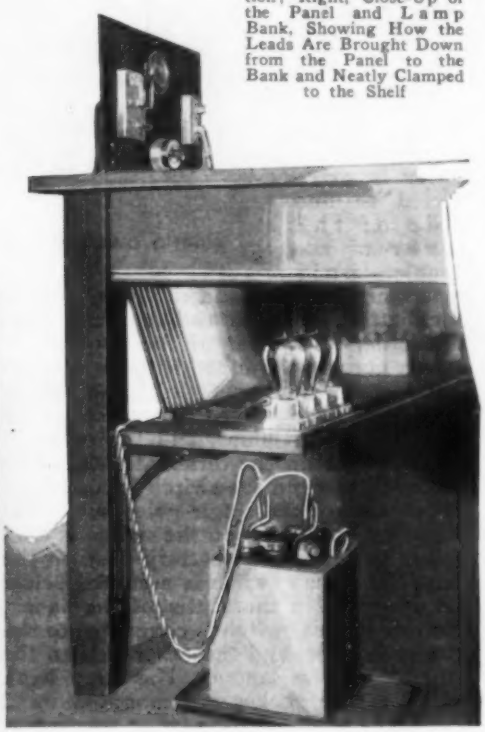
RADIO

Building a Charging Panel

IN certain parts of the larger cities, and in many other localities, the lighting current is direct. If this is the case, the tungar or the vibrating type of charger cannot be used for recharging radio batteries. It is a simple matter, however, to build a small charging panel that will meet the requirements. The reader who has a d. c. supply is fortunate, in a way, because a charging panel can be built for much less than he would have to pay for a charger of the rectifying type. The panel is so designed that the battery can be placed on charge by merely throwing two switches. This eliminates any changing of wires or danger of wrong connections.

Of the parts needed for building this instrument many will be found among the odds and ends around the home or workshop and the remainder can be bought at any electrical-supply dealer's. The requirements are: a bakelite or formica panel, 3/16 by 10 by 12 in.; two small angle irons; a baseboard ½ by 6 by 12 in.; one 25-volt, 15-amp. single-pole, single-throw knife switch; one 125-volt, 30-amp. double-pole, double-throw knife switch (these switches are of the common porcelain-base type); one cheap auto ammeter, reading charge and discharge; one 125-volt, 5-amp. snap switch; four porcelain cleat receptacles; three 32-cp. car-

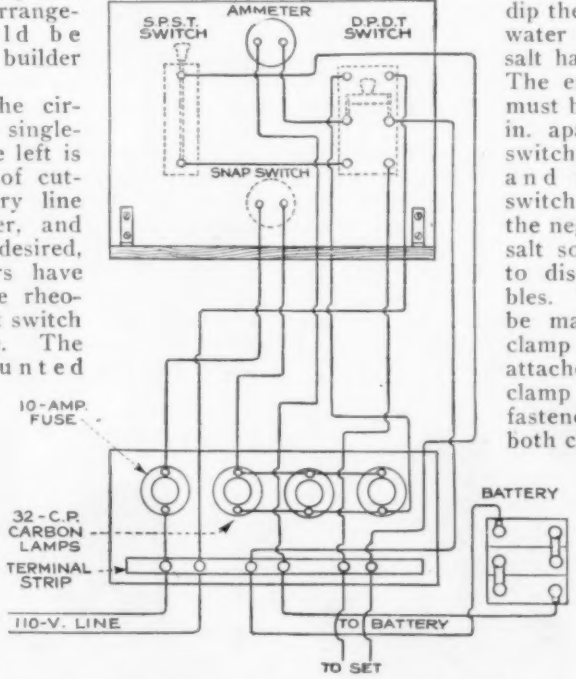




Left, Front View of the Panel, Nearing Completion; Right, Close-Up of the Panel and Lamp Bank, Showing How the Leads Are Brought Down from the Panel to the Bank and Neatly Clamped to the Shelf

bon lamps; a 10-amp. fuse; two battery clamps; one ½ by 6-in. bakelite strip for the terminals, and six binding posts; sufficient lamp cord or fixture wire to install the instrument; seven 6-32 brass or nickel-plated machine screws, ½ in. long; four 6-32 brass machine screws, 1 in. long, and sixteen wood screws. The reader will note that the instrument panel is mounted on a table, and the lamp bank on a shelf under it. This arrangement is recommended to avoid heating and warping of the panel, but any similar arrangement that would be handier for the builder can be used.

Referring to the circuit diagram, the single-pole switch at the left is for the purpose of cutting the A-battery line from the receiver, and can be omitted if desired, as most receivers have off points on the rheostats or a filament switch for this purpose. The ammeter is mounted flush with the front of the panel by means of three machine screws. This ammeter shows the rate of charge and discharge; one side of the ammeter is connected to one side of the lever of the double-pole switch at the right, and the other side to one battery post on the terminal strip. The other lever post of the double-pole switch goes to the other battery terminal on the strip. The upper left-hand post of this switch is connected to one side of the bank of carbon lamps, and the other to one line post on the terminal strip. The lower-left post on the switch is connected to one side of the single-pole switch and the other lower post on the switch is connected to the second battery post on the strip. The snap switch is mounted below the ammeter, in the center of the panel; one side of this switch is connected to the fuse receptacle, and the other side to the bank of carbon lamps. The lamp bank and the fuse socket are mounted on a board, the terminal strip being screwed at the rear of the lamp bank, the fuse at the left and the lamps in a line at the right. The circuit diagram clearly shows the method of connecting the lamps and fuse plug. The three 32-cp. carbon lamps will pass 3 amp.; this will answer for all practical purposes. If a greater current is desired, use more of the lamps; each lamp of this type will pass 1 ampere.



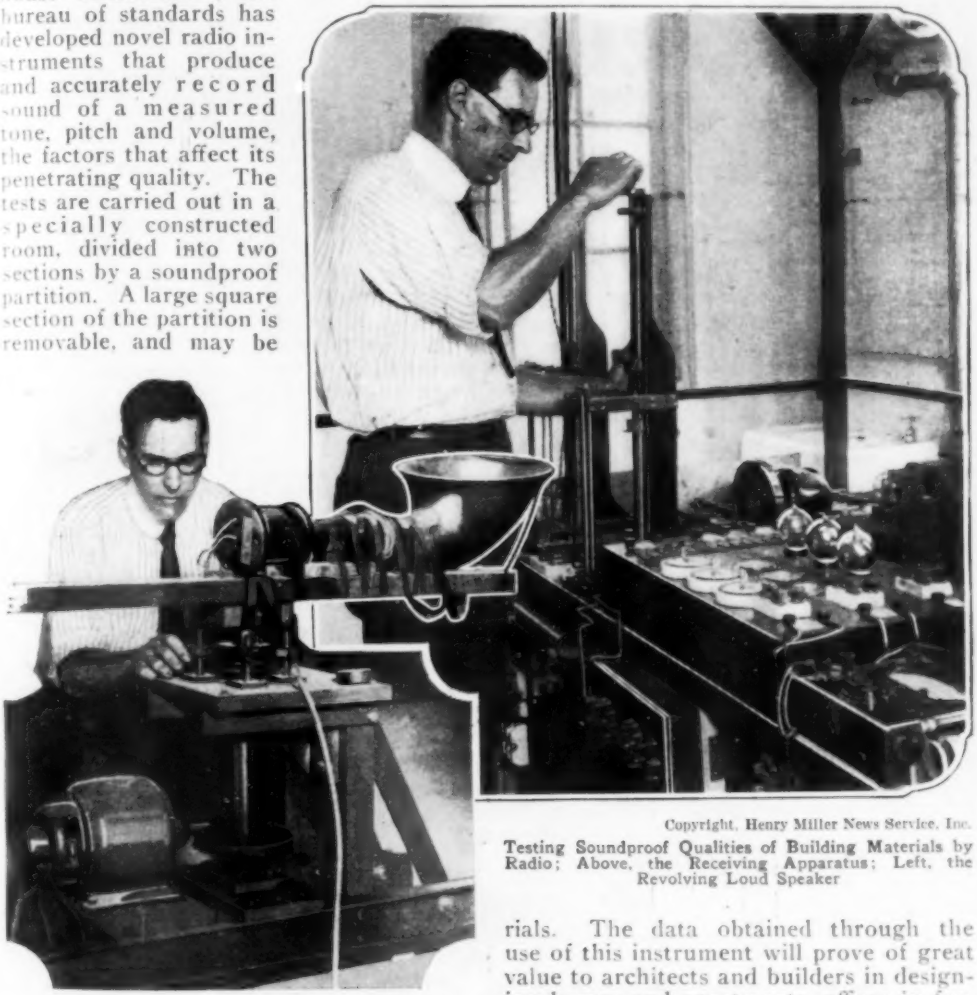
WIRING DIAGRAM FOR PANEL AND LAMP BANK

Before connecting the leads to the storage battery it is necessary to determine their polarity. Bare the ends of the wires, and dip them into a glass of water in which a little salt has been dissolved. The ends of the wires must be kept at least ½ in. apart. The snap switch being turned on and the double-pole switch lever thrown up, the negative wire in the salt solution will begin to discharge gas bubbles. This wire should be marked and the clamp marked negative attached to it. The other clamp should then be fastened to its wire and both clamps attached to the battery, positive clamp to positive terminal and negative to negative. Now, upon throwing the switches as before, the ammeter should read "charge." If it reads "discharge," reverse the ammeter connections. The single-pole switch should always be open, for safety's sake, when the battery is charging, and the snap switch turned off when the current is going to the set. The double-pole switch is thrown down and the single-pole switch thrown in when it is desired to use the set. To check the polarity of the wires leading to the set, use the salt solution as before, and mark the wires, or the terminal strip to which they are led, positive and negative.

¶A Washington inventor has developed apparatus that will photograph a message, transmit it by radio and reproduce it at the receiving end. The invention is expected to be especially useful in China, due to the number of characters in the language.

Soundproof Building Materials Tested by Radio

To determine the relative soundproof qualities of materials used in apartment-house construction, the bureau of standards has developed novel radio instruments that produce and accurately record sound of a measured tone, pitch and volume, the factors that affect its penetrating quality. The tests are carried out in a specially constructed room, divided into two sections by a soundproof partition. A large square section of the partition is removable, and may be replaced by a closely fitting section of the material to be tested.



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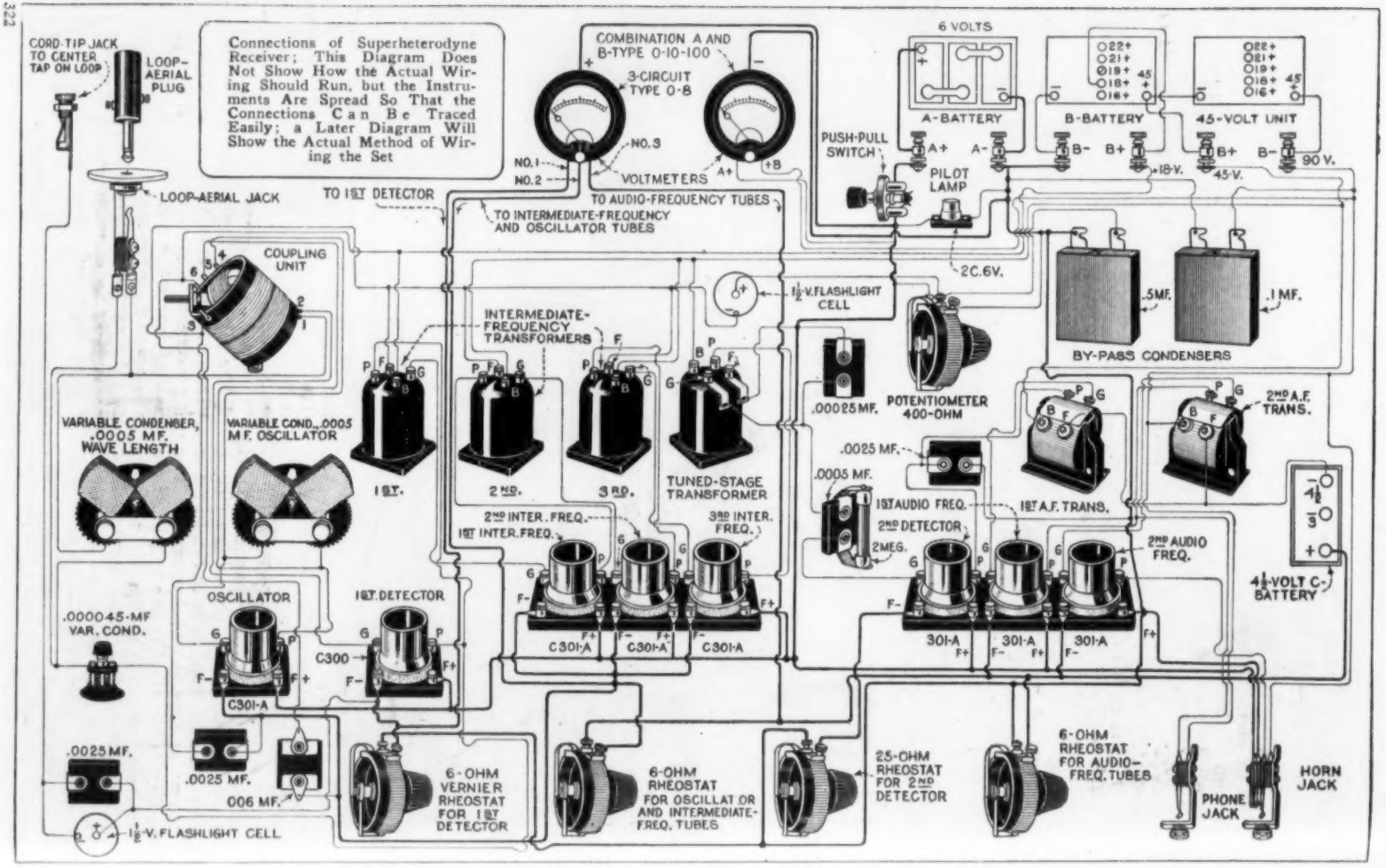
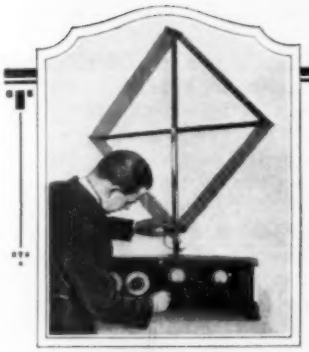
Testing Soundproof Qualities of Building Materials by Radio; Above, the Receiving Apparatus; Left, the Revolving Loud Speaker

The sound-producing apparatus is located on one side of the partition; this consists of a three-tube set with a circuit so arranged that the first tube can be made to "howl" at any desired frequency. The remaining tubes amplify the output of the first tube so that it can operate an ordinary loud speaker. The latter is mounted on a revolving arm, driven by an electric motor, so as to break up the sound "pattern" produced. The sound is picked up by a receiver on the other side of the partition, and the intensity of the signals received by the detector amplified so that they will deflect a sensitive galvanometer, thus affording a means of comparing the soundproof qualities of the various materials. The data obtained through the use of this instrument will prove of great value to architects and builders in designing homes and apartments, offices in factory buildings, or any other type of structure where the exclusion of noise is a matter of importance.

¶ The silverlike deposit on the inside of vacuum tubes occurs in the manufacturing process, when metallic magnesium is flashed inside the tube toward the end of the evacuating process. This is supposed to take up the last remaining gas inside the tube. Some tubes are of a reddish-brown color, and this is caused by a similar treatment, in which phosphorus is used in addition to the magnesium.


Connections of Superheterodyne Receiver; This Diagram Does Not Show How the Actual Wiring Should Run, but the Instruments Are Spread So That the Connections Can Be Traced Easily; a Later Diagram Will Show the Actual Method of Wiring the Set
CORD TIP JACK TO CENTER TAP ON LOOP
LOOP-AERIAL PLUG
LOOP-AERIAL JACK
COMBINATION A AND B-TYPE 0-10-100
3-CIRCUIT TYPE 0-8
NO. 1
NO. 2
NO. 3
VOLTMETERS
TO 1ST DETECTOR
TO AUDIO-FREQUENCY TUBES
TO INTERMEDIATE-FREQUENCY AND OSCILLATOR TUBES
6 VOLTS
A-BATTERY
B-BATTERY
45-VOLT UNIT
PUSH-PULL SWITCH
PILOT LAMP
18 V.
45 V.
90 V.
2 C.6 V.
COUPLING UNIT
1½ V. FLASHLIGHT CELL
.5 MF.
.1 MF.
BY-PASS CONDENSERS
INTERMEDIATE-FREQUENCY TRANSFORMERS
.00025 MF.
POTENTIOMETER 400-OHM
2ND A.F. TRANS.
VARIABLE CONDENSER, .0005 MF. WAVE LENGTH
VARIABLE COND., .0005 MF. OSCILLATOR
1ST.
2ND.
3RD.
TUNED-STAGE TRANSFORMER
.0025 MF.
.0005 MF.
1ST AUDIO FREQ.
1ST A.F. TRANS.
2ND DETECTOR
2 MEG.
2ND AUDIO FREQ.
4½-VOLT C-BATTERY
2ND INTER. FREQ.
1ST INTER. FREQ.
3RD INTER. FREQ.
OSCILLATOR
1ST DETECTOR
.000045-MF VAR. COND.
C300
C301-A
301-A
.0025 MF.
.006 MF.
1½ V. FLASHLIGHT CELL
6-OHM VERNIER RHEOSTAT FOR 1ST DETECTOR
6-OHM RHEOSTAT FOR OSCILLATOR AND INTERMEDIATE-FREQ. TUBES
25-OHM RHEOSTAT FOR 2ND DETECTOR
6-OHM RHEOSTAT FOR AUDIO-FREQ. TUBES
PHONE JACK
HORN JACK



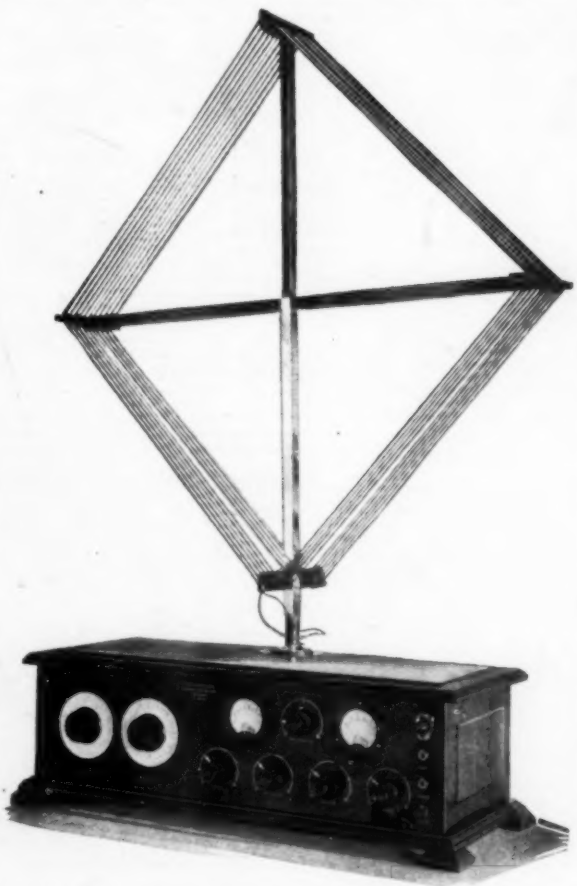
How to Build the Popular Mechanics' Superheterodyne Eight

By F. L. Brittin

REPRESENTING the closest approach to perfection yet attained, the superheterodyne circuit well deserves its widespread popularity. It is the general opinion of radio experts that any further advancement will not come until some discovery is made that will upset all our present methods of radio communication.

The superheterodyne receiver described in this article embodies all the most advanced ideas pertaining to this circuit. Nothing has been overlooked that would add to the efficiency of the instrument. Every piece of apparatus used in its construction has been carefully selected and thoroughly tested by the author; the completed instrument seemingly leaves little to be desired in selectivity, range and clearness of tone. All body-capacity effects have been eliminated by simple shielding, and the instrument is easily tuned, even by a novice, after a few minutes of instruction. The receiver can be built at a fraction of the cost of similar manufactured instruments, and has many refinements not yet included in the superheterodyne receivers on the market.

Any radio fan can build this instrument as only a few simple tools are required. If the reader follows the directions closely he will encounter very few difficulties. All parts are standard, and easily obtained from any dealer in radio supplies. There are many good instrument kits on the market for the construction of superheterodyne receivers, but the instruments in such kits are intended for operation in a circuit especially designed by the manufacturer. Such kits should not be purchased with a view to using the instruments in the circuit described here, as any departure from those specified herein will result in loss of the perfect balance that is absolutely necessary in this type of receiver. The



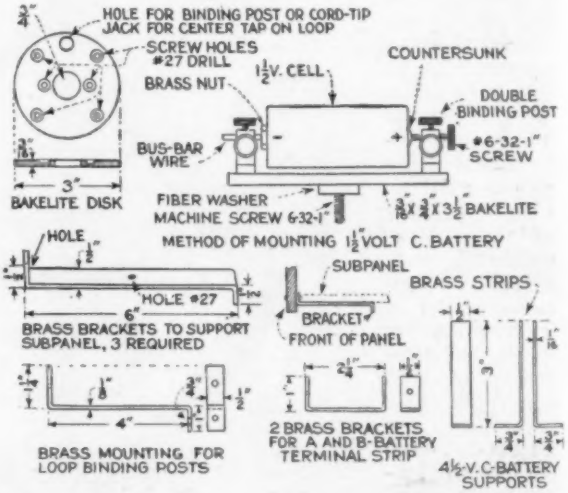
View of the Completed Superheterodyne Receiver, with Collapsible Loop Extended and Plugged into the Jack in the Cabinet Lid

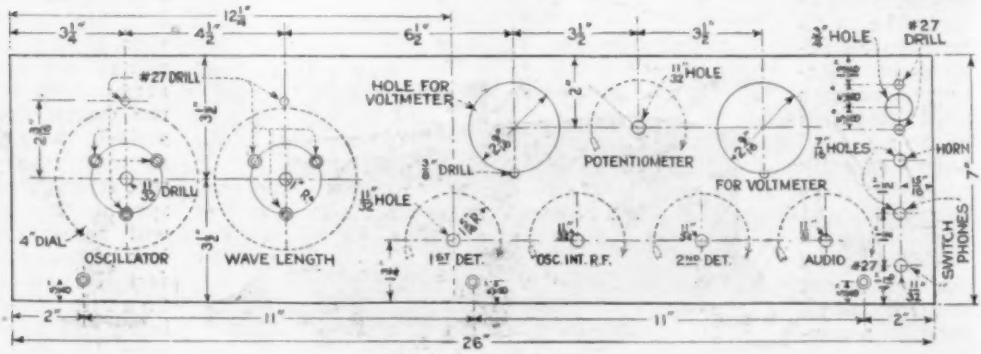
superheterodyne circuit employs a force that is extremely sensitive, and at the same time powerful, and cannot be compared to any other type of circuit.

Before attempting to build the instrument, read this article carefully, to become familiar with all the details. Obtain all the parts, even to the smallest items, such as screws, wire, lugs, etc., before starting actual construction. By doing this, you will find every step described much easier to follow. Equip yourself with a good small electric soldering iron, a small tin of non-acid soldering paste, and a coil of solid-wire solder. It is essential that all connections be soldered, using lugs under all binding posts, and also under all terminal posts of sockets, rheostats, voltmeters, and transformers. Screw these lugs down tightly and solder the connecting wires of the circuit to them; use very little soldering paste, and wipe it off carefully before applying the solder; the paste is used more to clean the surface than to act as a flux, and a very thin film is sufficient. The paste has a tendency to run under the terminal posts and make poor connections unless this precaution is taken. This advice is given in advance of all other construction details because poorly soldered connections will cause failure, even if every other detail is followed exactly.

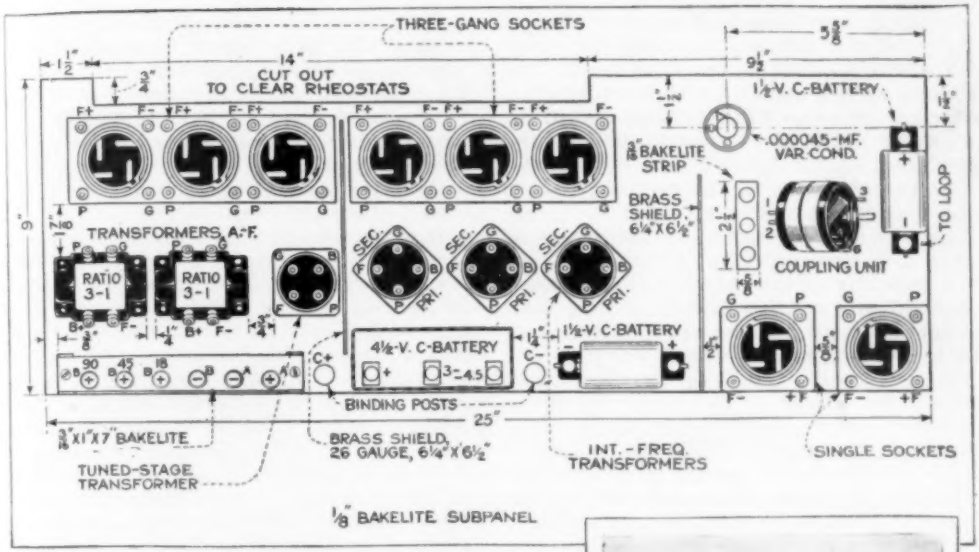
Some of the tools necessary are as follows: A pair of long-nosed pliers; blunt-nosed pliers; small side-cutting pliers; a small screwdriver; a heavy screwdriver; a small hacksaw; a hand drill; a center punch and a scriber. An ice-pick makes a good and easily obtained tool for this purpose. Do not make marks on the panel with a lead pencil.

Refer now to the drawing of the front-panel template. Obtain some heavy cardboard, such as bristol board, to make this. It is aways best to make a template of the front panel so that the holes for mounting the various instruments can be properly located. The panel is of radion, 7 by 26 by 3/16 in. in dimensions; these panels can be obtained already cut to this size from your local dealer and may be had in either mahoganized or black finish; the material machines well. Lay the panel on the bristol board and carefully outline it; then cut the bristol board to the exact size of the panel. On the template thus made locate the position of the holes for mounting the various instruments. Lay out this template exactly as shown in the drawing. In the template drawing the oscillator condenser is shown at the left of the panel, and the wave-length condenser to its right; in the diagram of connections this





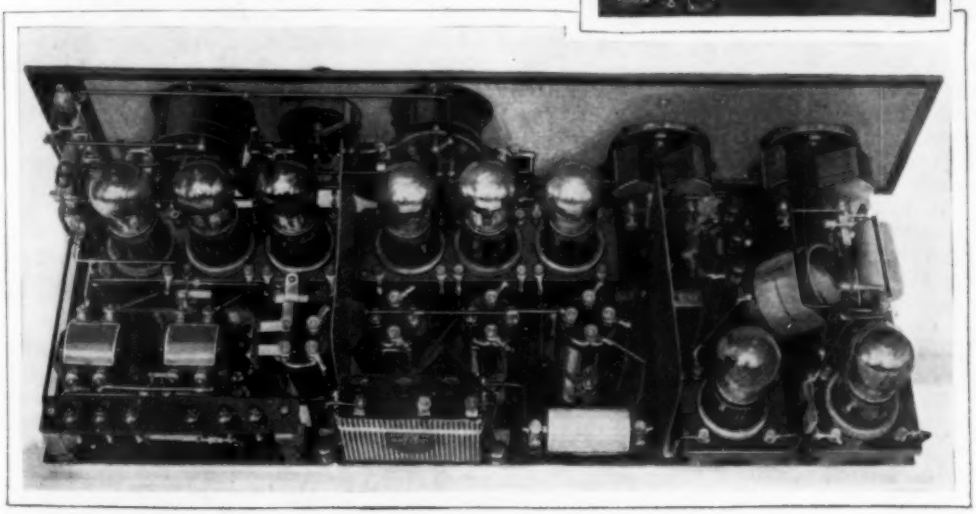
Above, Various Constructional Details; Method of Mounting Flashlight Cells, Disk for Loop Mounting, Binding-Post, C-Battery and Subpanel Brackets; Below, Layout of Template for Drilling Front Panel



Above, Layout of Subpanel, Showing Location of the Various Instruments; Below, View of Rear of Completed Instrument

arrangement is reversed. The panel template is correct, and the reverse arrangement was used in the diagram merely to simplify the tracing of connections.

After the template is completed, lay it on the panel and clamp it at the edges with small C-clamps, so that the template cannot shift on the panel while locating the holes for the instruments. Now, with the center punch or icepick, carefully mark the center of each hole through the template into the panel; make each mark in the panel deep enough so that no errors will be made when drilling, then remove the template from the panel. Always drill the panel from front



to back, never from back to front. It will be noted that the oscillator and the wavelength condenser holes, shown with the double circle, are to be countersunk for machine screws. A No. 27 drill is used for all screw holes, and an 1 1/32-in. drill for the shafts of the condensers and rheostats. The rheostats are of the new single-hole mounting type, and have a little projecting point at the outer edge, on the side that goes next to the panel. This point is for the purpose of preventing the rheostat from turning out of position; drill a small hole part way into the rear of the panel to fit it, being careful not to drill the hole any deeper into the panel than is necessary to take the point and permit the rheostat to lie flat against the panel. The rheostats are mounted with the terminals up, to facilitate the wiring of the circuit. The potentiometer is mounted in the same manner as the rheostats, except that the terminals are turned down. After the rheostats are fitted to the panel, remove them. Now drill the holes for the voltmeters; this will not be easy unless one is equipped with an expanding or wing bit. It will be best to have these holes drilled in the local machine shop. It is necessary first to make the 3/16-in. cut-out at the lower edge of the hole for the voltmeter; this is done with a 3/8-in. drill, right on the line of the larger hole, and the latter, 2 9/16 in. in diameter, is then drilled. The 3/16-in. cut-outs are to take the shafts of the little pointers and switches on the voltmeters. Place the voltmeters in the holes and mark off the mounting-screw holes. The exact location of these holes will be found when the voltmeters are fitted into place on the panel; care should be taken in marking and drilling them so that the voltmeters will be lined up correctly when the screws are placed in position. Use a No. 27 drill for the holes and nickelplated screws for mounting the voltmeters. They provide a check on the condition of the A and B-batteries at all times and prevent using excessive filament voltage.

In the upper right-hand corner of the panel will be found the 3/4-in. hole for mounting the red pilot light; the socket for this is of a standard nickelplated auto dash-light type and mounted on the front of the panel. The lamp is a 2-cp. 6-volt double-contact bulb, and can be had in colors (red is used by the author); this lamp is lighted whenever the instrument is in operation and reminds the operator not to leave the instrument without first cutting off the A-battery from the tubes; this feature will be appreciated by anyone who has inadvertently left his tubes lighted, and returned later to find his A-battery run down. The screw holes above and below the 3/4-in. hole are for the nickelplated machine screws used to mount the pilot-lamp socket.

Directly below the pilot lamp are the holes for mounting the horn jack, and lower down the hole for the phone jack; these holes are 7/16 in. in diameter. The horn jack is of the filament-control type, and the second audio-frequency amplifying tube remains unlighted until the plug from the horn or loud speaker is pushed into this jack. The author has found it unnecessary to use the loud speaker in the horn jack on many stations, even some 500 or more miles away, because the volume obtained when the loud speaker is plugged into the phone jack is more than sufficient; there is really more amplification than one knows what to do with, unless the instrument is detuned. For extremely distant stations, however, the second step of audio-frequency amplification can be used to good advantage. The phone jack is of the open-circuit type. The hole for mounting the push-pull filament switch is located directly below the phone jack; this hole is drilled with the 1 1/32-in. drill. Use the No. 27 drill for the holes at the lower edge of the panel, to mount the brass brackets that support the bakelite subpanel. The drilling of the front panel is now finished. If there are any instruments mounted on this panel, remove them, and the panel is ready for engraving; this can be dispensed with, if desired, and transfers or others markers used; however, engraving adds much to the appearance of the completed instrument, and good work can be obtained in most any city for from 3 to 5 cents a letter; for the arrows around the rheostat knobs the cost is from 12 to 15 cents each.

The next step after the panel has been engraved, and the builder has made sure that all holes have been drilled, and that those so marked have been countersunk, is to fit the sheet of tinfoil on the back of the panel. This tinfoil sheet is 6 by 24 in. in size; coat one side of the foil with a good grade of orange shellac and stick it on the back of the panel. The foil should be placed on the panel 1/4 in. from the end where the oscillator and wave-

What are your radio problems? Perhaps the same trouble that perplexes you has also been encountered by another reader. Turn to page 352 and you may find the solution among the questions and answers there. If not, write to us, and the services of our radio experts will be placed at your disposal. This service is free, so do not hesitate to ask us to help you.

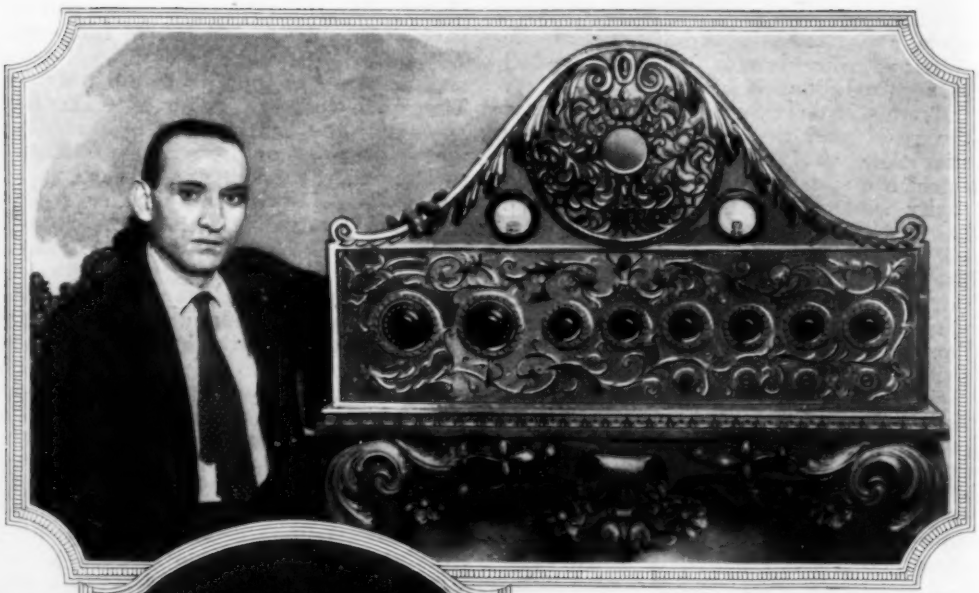
length condensers are to be mounted, and ½ in. from the top and bottom of the panel; it will now reach across the panel to a point about 1¾ in. from the other end; this is clearly seen in the photo of the rear-panel assembly. The foil will stick tightly to the panel and effectually shield the instrument from any hand capacity when tuning. Before the shellac has had time to dry hard, cut away the foil from around the instrument-mounting holes (a safety-razor blade is handy for this purpose); be sure that the foil does not touch any of the instruments when they are mounted on the panel. The writer used a 3-in. square of mica between each of the rheostats and the panel, and also between the potentiometer and the panel. Thin mica sheet was used, and a hole sufficiently large for the shafts of the instruments cut with the points of a pair of dividers. This is an extra precaution, but insures that no metal on the rheostats or potentiometer will come in contact with the foil. Use a little alcohol for removing any traces of shellac remaining on the panel.

The brass brackets for supporting the subpanel are then screwed to the lower part of the panel and make contact at this point with the foil, for grounding the shield; these brackets are made from ⅛-in. brass strip, ½ in. wide and 7 in. long. A ½-in. bend is made at each end in the manner shown in the detail drawing. There are three of these brackets, and holes for the machine screws used to mount the panel on the brackets are drilled through the upturned end of each, using a No. 27 drill. A hole is also drilled through the center of each bracket for the short ½-in. machine screws used to mount the subpanel on the brackets. The turned-down ends of the brackets then form supports for the subpanel and rest on the bottom of the cabinet; the brackets hold the subpanel ½ in. above the bottom of the cabinet and permit wiring under the subpanel. Remember that the subpanel is not yet mounted on the brackets; the latter are supporting the front panel by means of machine screws through the upturned ends; the screws used have flat black-japanned heads, and are countersunk flush with the front of the panel. The brackets act as a support for the front panel and all the instruments of the latter can now be mounted in their proper positions, after soldering lugs have been placed under all the instrument terminals. The front panel is then completed.

(Continued Next Month)

LIST OF MATERIALS

1	3-16 by 7 by 26 in. radion panel mahoganized (or black)	$ 4.00
1	⅛ by 9 by 25 in. formica or bakelite subpanel	3.38
3	No. 600 Remler intermediate-frequency transformers	18.00
1	No. 610 Remler tuned-stage transformer	6.00
2	No. 631 Remler .0005-mf. capacity units (variable condensers), complete with dials	10.00
1	No. 620 Remler coupling unit	3.00
2	No. 619 Frost shock-absorber sockets, 3-gang type, standard base	6.50
2	No. 618 Frost shock-absorber sockets, single, standard base	2.50
1	No. 651 Frost vernier rheostat, 6-ohm, single-hole mounting type	1.25
2	No. 650 Frost rheostats, 6-ohm, single-hole mounting type	2.20
1	No. 657 Frost rheostat, 25-ohm, single-hole mounting type	1.25
1	No. 654 Frost potentiometer, 400-ohm, single-hole mounting type	1.25
1	No.233 Frost jack, open-circuit type	.70
1	No. 235 " jack, filament-control type	.95
1	No. 608 " push-pull filament switch	.30
1	No. 250 " loop jack and plug complete	1.50
1	No. 850 Chelton midget variable condenser .000045-mf., table-mounting type	1.50
2	R-12 All-American audio-frequency transformers, ratio 3 to 1	9.00
1	No. 55 Jewell voltmeter 0-8 volts, d.c., three-reading type	10.00
1	No. 55 Jewell voltmeter, combination A and B, 0-10 and 0-100	10.00
1	Mathiesen collapsible loop, three-terminal type	12.50
1	No. 601 Dubilier micadon condenser .006-mf.	.75
3	No. 601 Dubilier micadon condensers .0025-mf.	1.20
1	No. 601 Dubilier micadon condenser .0005-mf., with grid-leak clips	$ .45
1	No. 601 Dubilier micadon condenser .00025-mf., plain	.35
1	Dubilier by-pass condenser .5-mf.	.90
1	" by-pass condenser 1-mf.	1.25
1	Daven grid leak, 2 meg.	.50
2	1½-volt flashlight cells	.40
1	bakelite disk 3-16 by 3 in. in diameter	.15
1	auto dash-light socket, nickel, flush-mounting type	.35
1	auto lamp, 2 cp., 6-volt (red if possible)	.30
1	strip of bakelite, 3-16 by 1 by 7 in.	.14
2	strips of bakelite 3-16 by ¾ by 3½ in.	.16
6	binding posts, Eby type, with engraved tops for A and B-bats	1.20
5	binding posts, plain	.50
20	2-foot lengths of tinned-copper bus-bar wire	.75
15	3-foot lengths of good-grade black spaghetti tubing	1.80
7	doz. tinned-copper lugs, long type, round hole	.70
1	strip of bakelite, 3-16 by ⅝ by 2½ in.	.06
4	double binding posts	.40
1	sheet tinfoil, 6 by 24 in.	.10
2	brass sheets .016 in. thick, 6¼ by 6½ in.	.40
3	brass brackets ⅛ by ½ by 7 in.	.45
1	brass bracket ⅛ by ½ by 6 in.	.10
2	brass brackets 1-16 by ½ by 4½ in.	.15
1	4½-volt Burgess C-battery	.40
8	6-32 brass machine screws, 1½ in. long, with nuts	.10
2	6-32 brass machine screws, 1-in. long, with nuts	.05
15	6-32 brass machine screws, ¾ in. long, with nuts	.15
26	6-32 brass machine screws, ½ in. long, with nuts	.30
6	wood screws, nickelplated, oval head, 1 in. long	.10



Here Are a Few of the Freak Sets Shown at the Radio World's Fair. At the Top Is Shown Alfred Savastano's Superheterodyne, with Its Panel of Beaten, Chased Copper, and Its Built-In Loud Speaker. At the Left Is the "Lollypop" Crystal Set, Which Miss Mary Junk Says She Likes Better Than Any of the Multi-Tube Sets She Has Seen; Above, a Real Receiver Built in a Watch Case, and a Crystal Set Built as a Miniature Piano; the Pen Merely Shows the Relative Size, and Is Not a Radio Receiver

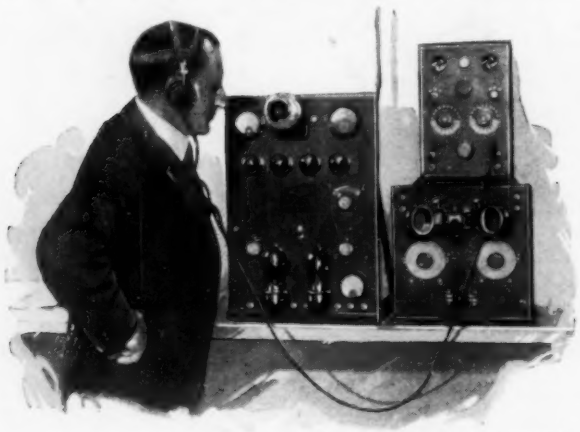
The Tiny Crystal Receiving Set Mounted on a Wrist Strap, Shown Above, Proved Very Popular with the Ladies at the Show, as Did the Set Built into a Vanity Case Shown at the Right; Considerable Ingenuity Is Displayed by the Builders of Sets like These, and the Best of It Is That, Despite Their Unconventional Design, They Work, and Work Well

© Keystone

Above, the World's Smallest Loud Speaker; in Spite of Its Diminutive Size, It Has a Clear Tone and Can Be Heard for a Radius of 10 Feet; Right, Another Freak Built like a Miniature Chair

"Baby" Transmitter Made for Home Use

Dr. Lee DeForest's latest invention, a compact portable radio-telephone transmitter, is designed for use in the home, in the office, on large ranches, etc. This



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Designed for Use on 110-Volt Current, This "Baby" Transmitter Has an Operating Range of 30 Miles

wonderful little instrument has an operating range of close to 30 miles, and sound-wave filters prevent interference or unauthorized listening in, as the receivers used with the set can be adjusted to pick up the waves from the transmitter while other sets cannot. The whole outfit is designed so that it can be operated by an amateur. It is anticipated that it can be sold for around $200, and if this can be attained, such "baby" sets will find a wide field of usefulness.

Resin-Core Solder Aids in Wiring Sets

In conquering the problem of radio frequency, radio engineers and manufacturers learned of the importance of using only a pure resin flux for all soldered joints. Tests show that where acids, pastes and compounds are used, they either spatter, fume or run over surrounding delicate parts. This causes leakage and reduces resistance in a manner comparable to a grid leak. Therefore these fluxes should never be used on radio work.

To assist in developing better soldering, a special radio solder has been put on the market in a most convenient form. It is a hollow ribbon of genuine tin and lead, having inside a pure resin flux. This flux is in proportion to the surrounding solder and feeds out as the solder is used.

Economy Tips for Battery Users

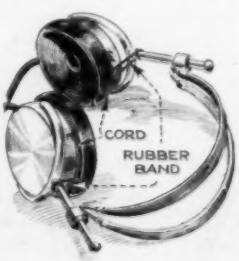
Do not use too small a B-battery in the set. The smaller sizes will not give good service in multiple-tube sets, as they will depreciate rapidly, necessitating frequent renewals. The number and type of the tubes, as well as the range desired, should determine the size of battery required.

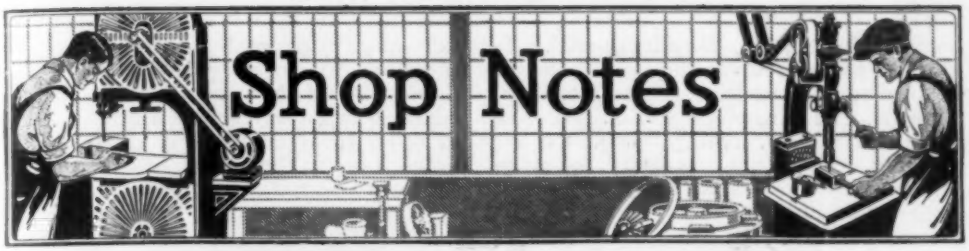
Make certain that the B-battery is not connected to the A-battery terminals, or the filaments of the tubes will be burned out. Burn the tubes at the lowest possible point that will give good reception. Turning them higher will not give better results and will drain the battery more rapidly. Do not touch the rheostat after it has been adjusted properly. Don't use any more tubes than necessary to bring in the desired station. Many users burn all the tubes in a multiple-tube set on local stations, for example, and then detune to lessen the volume of sound. This is very wasteful. For local stations it is seldom necessary to use more than the first stage of audio-frequency amplification.

Current is flowing as long as the filament is lighted. Common sense demands, therefore, that the tubes be turned out as soon as the user has finished listening.

Preventing Headphone Cords from Twisting

Headphones often have a tendency to turn around in the frames that hold them and this causes the cord to kink, making it unhandy to put the set over the ears. An easy way to overcome this difficulty is to remove each phone and slip a short heavy rubber band over the sliding adjustment rod, as shown in the illustration: unscrew the rubber cap of the phone; pass a piece of string through the rubber band, and wind the string in the last two threads on the phone body. Then, by screwing the cap tight, the string will be securely held on the shell, and the phones cannot turn.—L. B. Robbins, Harwich, Mass.



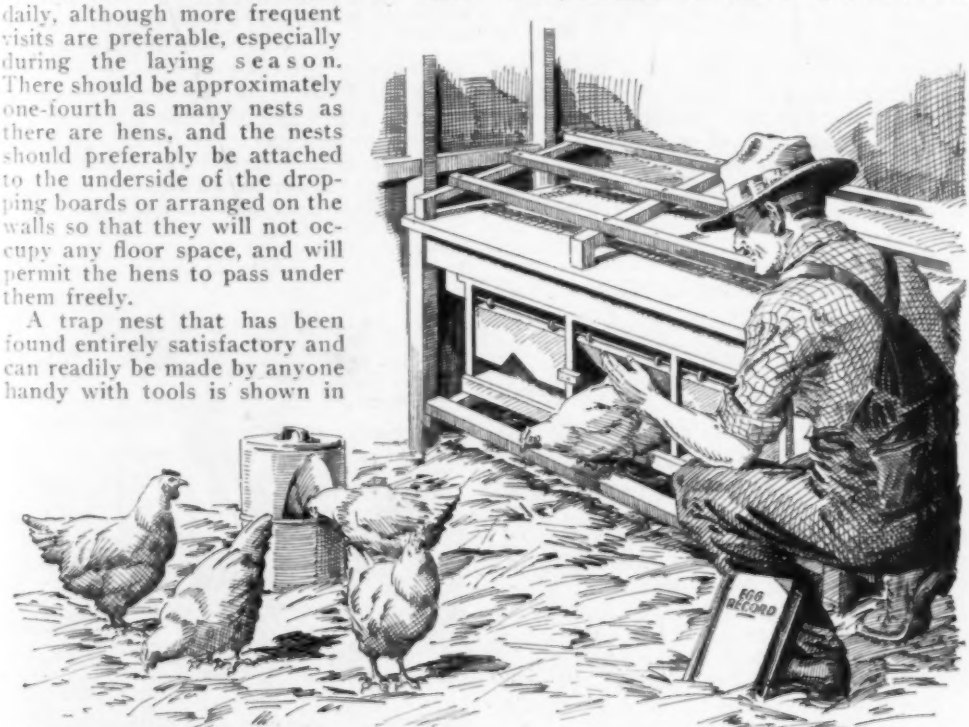


All Shop Notes published in 1924, in book form—Fifty Cents—from our Book Department

A Simple Trap Nest for Poultry

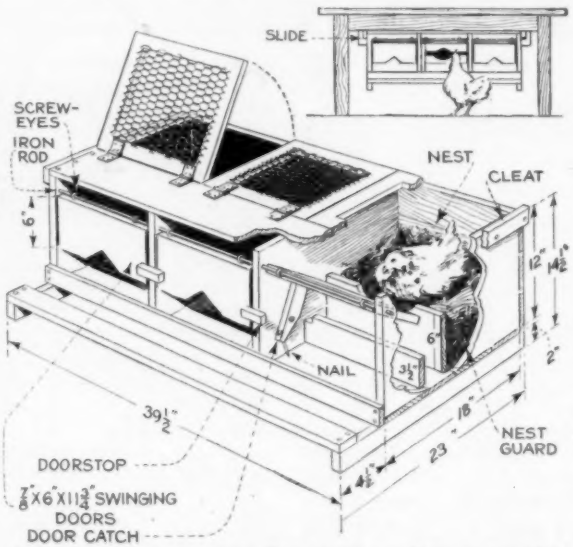
COMMERCIAL poultrymen, who keep and breed hens for egg production and for exhibition, regard the use of trap nests as highly essential for obtaining accurate egg-laying records. Upon the basis of these records the unprofitable hens are culled out of the flock, and eggs from the most productive hens are selected for incubation. A trap nest is so arranged that the entrance of a hen automatically closes the door and confines her in the nest until released by an attendant, who notes the number on her leg band and sees that she is properly credited in the record book, if she has laid an egg. The attendant should visit the nest at least four times daily, although more frequent visits are preferable, especially during the laying season. There should be approximately one-fourth as many nests as there are hens, and the nests should preferably be attached to the underside of the dropping boards or arranged on the walls so that they will not occupy any floor space, and will permit the hens to pass under them freely.

A trap nest that has been found entirely satisfactory and can readily be made by anyone handy with tools is shown in the illustrations. It is a three-compartment nest, which has cleats on the ends so that it can be held in slides attached to the dropping boards, to permit its easy removal whenever it is necessary to clean and disinfect it. The nest is made of ⅞-in. and ½-in. lumber, the ⅞-in. material being used for the ends and partitions, which measure 12 by 18½ in., and the ½-in. material for the bottom, back, strips along the top and front, and for the crosspieces in each nest, which serve to keep the nesting material away from the door. The doors are cut from ⅞-in. wood, and the ledge along the front is a length of 1 by 2-in. wood, mounted on cleats fastened to the



Simple Homemade Trap Nest That Enables Poultryman to Obtain Accurate Egg-Laying Records, on Basis of Which He Eliminates Unprofitable Hens and Selects High-Grade Eggs for Incubation

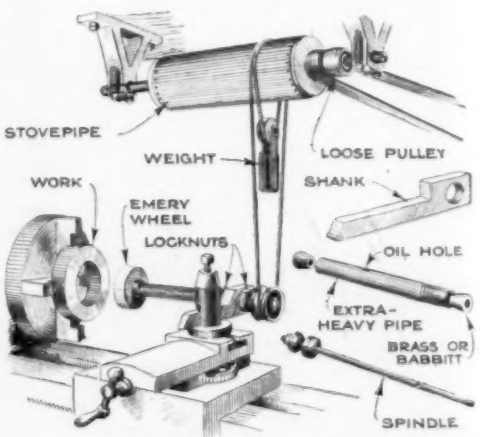
bottom of the nest. Wire mesh with a 1-in. opening is used for the top; it should be stapled to a frame made of 1 by 2-in. material, and hinged on as indicated, to make the interior readily accessible for cleaning. It is not necessary to make three separate doors on top as shown in the illustration; one covering the entire top is sufficient. A wire-mesh top is preferable to a wooden top as it permits better ventilation. Most of the dimensions are given and the others can readily be approximated. Two screweyes are driven into the top edge of each door so that it can be hung on a length of 3/16-in. iron rod, which is pushed through the ends and partitions, holes being drilled for this purpose. The doors are opened by swinging them inward and are kept in this position by means of a wooden latch. When the hen enters the nest she raises the door and this releases the latch, which is pivoted eccentrically so that it readily falls to a horizontal position, permitting the door to close against a stop. The doors should be planed down on the edges to fit loosely between the partitions in order to avoid binding. A triangular notch is cut in the bottom of each door, as shown, to permit the hen to pass into the nest more easily; the size of the notch must, of course, be varied according to the size of the hens using the nest. The latch is made of ½-in. material and is 1½ in. wide at the upper end and ¾ in. wide at the lower end. A nail or screw is driven through the narrow end at such an angle that it will serve as a stop, permitting the latch to be raised just far enough under the edge of the door to hold it. To prevent the latch from sticking, it is advisable to drill a hole through it and pivot it loosely on a wood screw of smaller diameter, a washer being provided on each side. It is best to use hardwood for the latch as the pivot hole will not wear so readily.



Method of Constructing the Trap Nest; the Door of the Right Compartment Is Open to Show the Latch; It Normally Closes When the Hen Enters

A Toolpost Grinding Fixture

A toolpost grinding fixture for the lathe that will answer equally well for internal and external work as for surface grinding and is within reach of even the smallest shop, is shown herewith. A piece of flat stock, ½ by 2 by 6 in., is cut to the shape shown, the narrow part forming a shank fitting into the toolpost slot. A 1 1/16-in. hole is drilled through the wide end. An 8-in. length of extra-heavy ¾-in. pipe is threaded for a distance of 1½ in. from one end and brass or babbitt plugs are tightly driven into each end. The plugged pipe is then chucked in the lathe and the plugs drilled and reamed to fit the ⅝-in. grinding-wheel spindle; the ends of the pipe are faced to become thrust bearings for the collars on the shaft. An oil hole is drilled somewhere near the



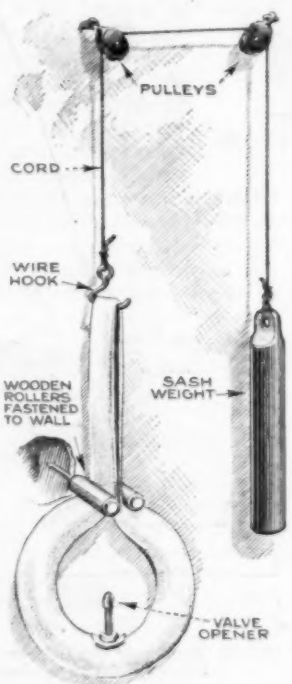
An Easily Constructed Toolpost Grinding Fixture for the Lathe That Is Adaptable to Internal, External and Surface Grinding Operations

center of the pipe, which becomes an oil reservoir when the shaft is in place. The pipe bearing is secured to the shank by means of locknuts, such as those obtainable from any electrical contractor who uses them in conduit work. The spindle is turned from a 10-in. length of 1-in. stock and a small grooved pulley, drilled to fit the spindle, is held to it with a setscrew, so that end play can be taken up.

The drum pulley is simply a length of 8-in. furnace pipe that is fitted with wooden heads, the driving pulley being integral with one of them. The heads are turned with a slight taper so that they can be easily driven into the pipe and fastened with small nails. The belt take-up consists of nothing more than a grooved pulley with a weight attached; this permits of moving the cross slide in any direction. A ⅜-in. round belt is used between the drum and grinder.—Edwin J. Bachman, Fullerton, Pa.

Automatic Inner-Tube Deflator

Deflating inner tubes after they have been tested is a tedious and time-consuming task in the vulcanizing shop; but this work can be done automatically by means of the simple device shown in the drawing. It consists of two wooden rollers, spaced about ½ in. apart and mounted on the wall at a convenient height. A length of sash cord, to which a weight and a wire hook are tied, is run over two pulleys attached to the wall or ceiling. The inner tube is hung on the hook and forced between the rollers, and the weight will then pull it upward until all the air is squeezed out. The valve must, of course, be open.



Protecting Young Trees

Young trees can be protected against cold by means of old inner tubes and casings slipped around the trunks as shown in the drawing. In the case of very small trees the tubes can be slipped right over the branches, the latter being squeezed together with one hand. The tube is then tied with twine as shown. For larger trees casings may be used, as shown at the right. In the spring the coverings are taken off. After their removal a rubbery odor will be left on the bark, which insects and other vermin dislike.—W. Mehanna, Bussey, Ia.

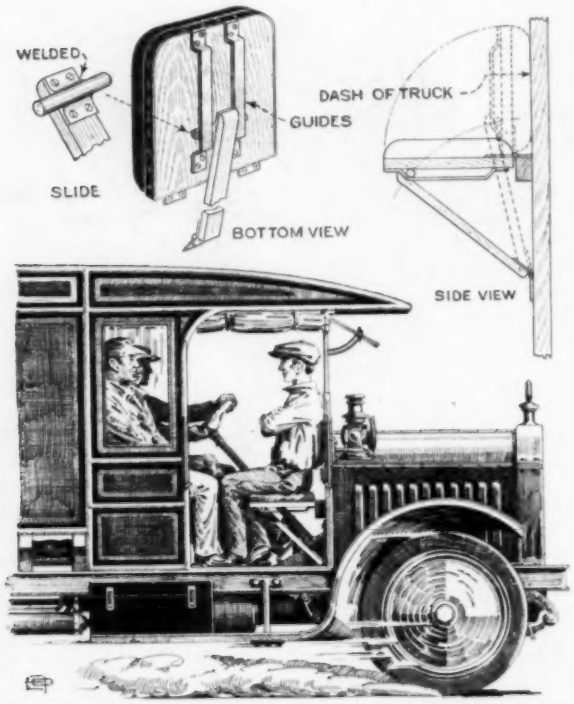
Old Casings and Inner Tubes to Protect Young Trees during Winter

Cleaning Conduit

I recently had some experience in cleaning conduit and other pipe into which some concrete had run and set. Some of the pipes were in places almost inaccessible, which made it very difficult to remove the concrete. However, the following method proved quite effective. Obtaining a 6-ft. length of six-strand cable, made of No. 10 wire, I spread the strands on one end so that the diameter of the flared end was about twice the diameter of the pipe. The ends of the strands were then bent to form hooks, which turned outward radially. After driving an iron bar through the center of the pipe, I was able to shove the cable through the hole thus made, and in pulling the cable out again, the hooks caught in the concrete and brought it out whole or in pieces, the process being repeated until the pipe was clean.—Morris K. Jessup, Monroe, Mich.

Truck Seat for the Extra Hand

Long-haul trucks carrying building material, furniture, etc., usually have a crew of sufficient size to enable the loading and unloading to be done with ease and dispatch. Long journeys require some facilities for seating the crew, and where the extra hand cannot be accommodated on the load, or in wet weather, the simple folding seat shown in the drawing will be appreciated, as the regular truck seat usually will not take more than two without inconveniencing the driver.

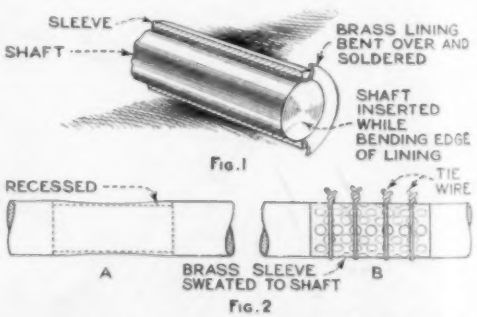


The Extra Helper Is Accommodated on a Long Haul by a Simple Folding Seat in the Cab

The seat proper is hinged to a piece of wood bolted to the inside of the dash, and has two slides made of flat steel screwed to the underside. The bracket that supports the seat is also hinged to the dash, and, at the top, has a piece of round steel that will slide under the flat-steel slides fastened to it. The simplest method of attaching the rod is to weld it to a flat-steel bracket, which is drilled for heavy screws. The top of the seat may be padded, as shown, and, when not required, folds flat against the dash as indicated by the dotted lines in the side view. With this arrangement the extra hand is fully protected from rain and snow.

Making Temporary Bushings

Replacement of worn parts on machines and automobiles, which usually involves considerable expense, is unnecessary if temporary repairs can be made to give additional service. This is the case especially with bearings, bushings, sleeves, shafts and spindles. In Fig. 1 is shown a lining put inside of an enlarged sleeve. It takes away considerable play, reducing noise to a minimum and putting the working parts back into correct alinement. The sleeve is removed and the amount of play accurately measured all around. A piece of sheet brass or tin of one-half this thickness is carefully cut so that when turned to cylindrical shape and inserted inside of the sleeve it will fit exactly. The sleeve, with the lining in it extending a trifle, is put on the end of the shaft, and the edge of the lining is tapped over and soldered to the edge of the sleeve so that it will be held in place securely. If the shaft fits too tightly, a piece of emery cloth is wound on a round stick and the surface of the lining brought down a trifle until it slips over the shaft easily. In soldering tin to steel a flux consisting of muriatic acid cut with zinc has been found effective. Fig. 2 shows a repair made on a worn shaft where it has been scored by a bearing or sleeve. The shaft is recessed about $\frac{1}{64}$ or $\frac{1}{32}$ in. by turning the scored part down in the lathe as shown in detail A. A piece of sheet brass corresponding in thickness to the depth of the recess is cut to the same width and long enough to fit around the shaft so that the ends fit together

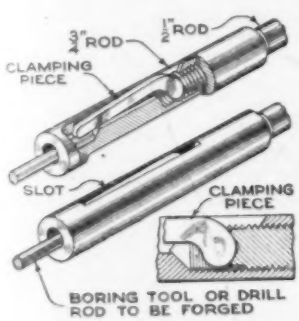


Making Temporary Bushings for Bearings and Building Up Wearing Surfaces of Journals

snugly. Holes are punched in it and it is wired to the shaft as shown in detail B. The sleeve thus formed is sweated on the shaft, the holes being filled with solder and the wires then removed. The excess thickness is turned down on the lathe to the thickness of the shaft and the repair is complete. The shaft is then just as useful as it was before and the cost of repairing it is negligible compared to the cost of a new shaft.—J. E. Decker, Chicago, Ill.

Holding Small-Diameter Rod

Attempts to hold short lengths of the smaller sizes of drill rod or cold-rolled stock in the ordinary tongs for flattening the ends or bending them over to form boring tools, are likely to result disastrously, as very frequently the work jumps out of the tongs at the first blow of the hammer. In such cases there is always the possibility of the flying bit of metal striking the operator or someone else. Few shops have tongs that are in good enough condition to hold these small pieces securely and for such the holder shown in the drawing will be found not only convenient but safe. It is made from two pieces of cold-rolled stock, one ¾ in. in diameter, the other ½ in., and a flat clamping piece. The larger rod is drilled with a ¼-in. hole at the front end and drilled and tapped at the opposite end to take the smaller piece, which is threaded, and may be as long as desired to serve as a handle. The large rod is slotted to take the clamp, the front end of the slot being tapered. The clamp is made from flat stock, about 5/32 in. thick, and shaped as in the drawing. A slight vee is filed on the underside of the clamping piece where it bears against the pieces held.



When a rod is slipped into the hole in the front end of the holder the ½-in. threaded rod is screwed up, forcing the clamping piece forward and downward, and tightening it on the work. The work is released from the holder by unscrewing the threaded piece, when the work will drop out, provided it does not fit tightly.

Convenient Sawhorse

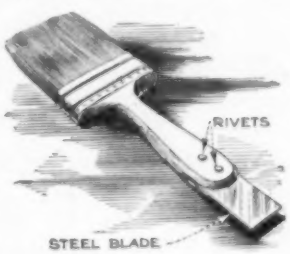
In order to save the trouble of carrying a pair of sawhorses about from job to job, a carpenter has added crosspieces

Crosspieces Make Single Sawhorse Give Service of Two

to an ordinary sawhorse. He can then lay his boards to be sawed over the crosspieces and saw with as much convenience and ease as if he used two horses. This horse is also more steady.

Combination Paintbrush and Scraper

It frequently happens that a painter wants to use a putty knife to scrape off some foreign matter from the surface he is painting and that the knife is not within convenient reach, or he has to lay his brush down while reaching into a pocket for the knife. To eliminate this waste of time, a painter made the combination tool shown in the drawing. The end of the handle was split and a piece of steel inserted in the split, where it is held by two rivets.



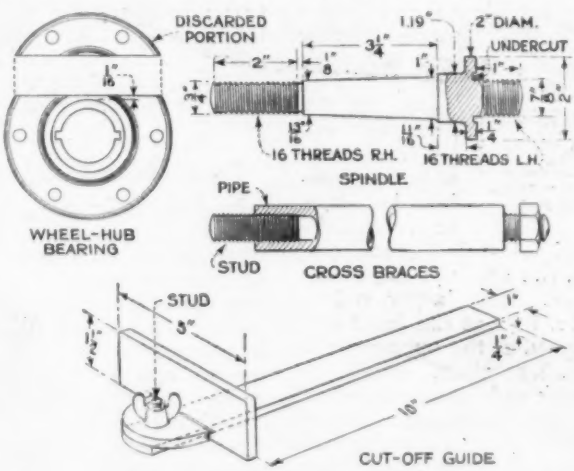
¶ Smoke from soft coal will cause varnished furniture to look cloudy.

MAKING AN 8-INCH BENCH SAW

By J.V.Romig

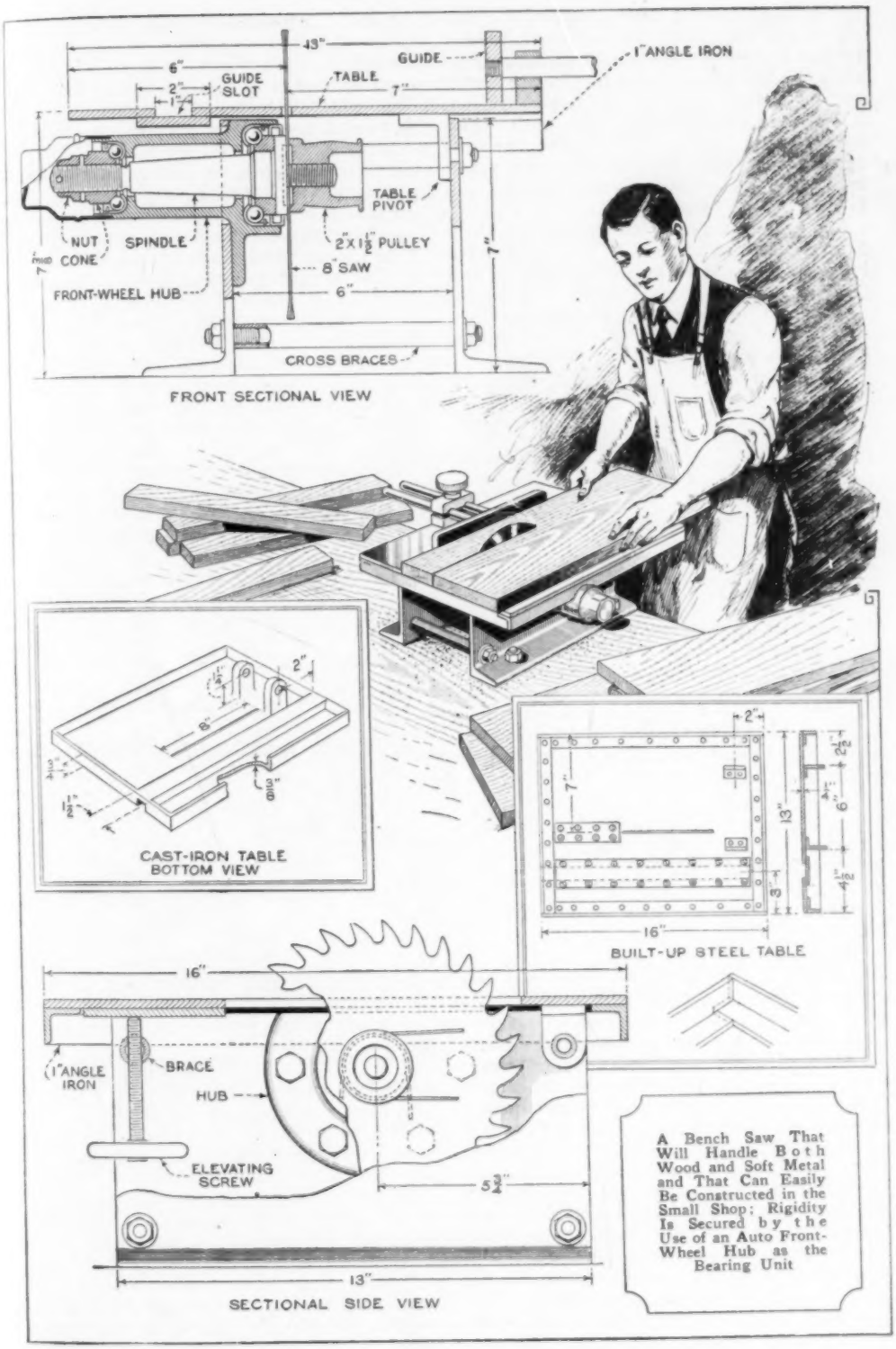
ALMOST necessary tool for the small shop is the bench saw, with which it is possible to cut both metal and wood, and which is fitted with guides for ripping and cut-off work. With such a machine, at a cost of a few cents an hour for power, many times the amount of work can be done that is possible with hand methods, and with less physical fatigue.

Such a saw can easily be built from steel flats and structural shapes, together with machined parts taken from other machinery. It may be designed in an excellent manner, and built at low cost. To obtain rigid bearings, with long life, is the main thing to consider in the design, and it is with this in mind that a Ford front-wheel hub has been selected for the bearing unit in the saw described in this article. These hubs can be bought from any service station at a cost of a little over $1 a piece. They come with the two ball races and bearings assembled. By the use of the hub a strong, rigid bearing is secured, that can be taken up when any wear takes place and is easily lubricated, by filling the cap with grease in the regular manner and giving it an occasional turn. The bearings may also be made dust-tight by using the regular Ford dust washer, which is made of steel and lined with felt.



The most important part of the tool the builder himself must make is the spindle. This is turned from a good grade of steel and threaded as shown in the drawing. The seat for the large cone bearing, at the right, must be made exactly 1.19 in. in diameter, as it must be a light driving fit on the seat. The small cone, or race, screws onto the other end of the spindle, which is threaded 16 to the inch, the cone being an easy turning fit. A washer and locknut are used to hold the small cone in place, after it is adjusted. The two cones should also be bought from a service station, as this is very much cheaper and more satisfactory than trying to make and harden them correctly. The shoulder behind the larger cone is turned to a diameter of 2 in., and the end, which is ⅞ in. in diameter, is also threaded 16 to the inch, but left-hand. This shoulder is slightly undercut, as shown in the drawing, so that the saw will come up close against the seat. A bearing and mandrel unit is thus obtained, capable of standing up under the stress of sawing metal and of being kept without side play, which is necessary to insure a good clean cut that will need little hand planing or filing. To insure proper tightening of the saw, it is well to cut a spanner-wrench slot in the shoulder of the spindle and drill a pin-hole in the driving pulley; the latter acts as a nut for the saw, and has a left-hand thread to fit the spindle.

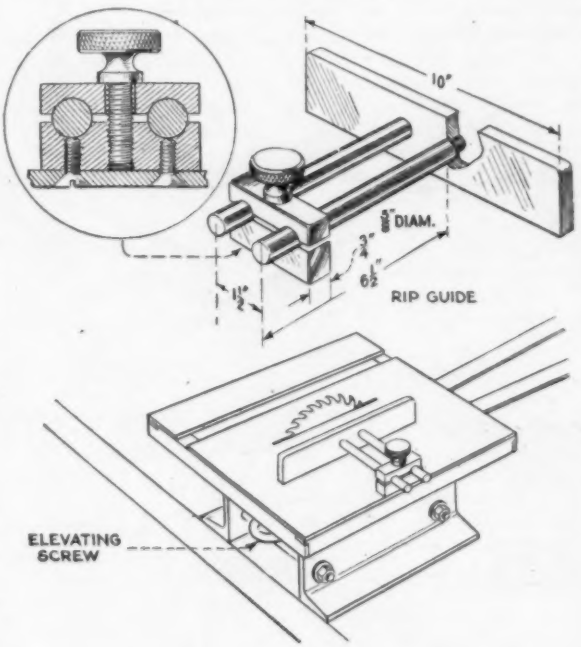
The saw frame is made of channel iron, with the top flange cut off as shown. The



A Bench Saw That Will Handle Both Wood and Soft Metal and That Can Easily Be Constructed in the Small Shop; Rigidity Is Secured by the Use of an Auto Front-Wheel Hub as the Bearing Unit

lower flanges serve as the base of the machine, and lagscrews are used to fasten the tool to the bench; bolts, of course, may be used if desired. These pieces are easily cut to length, and require only drilling. They are coupled together with cross braces made from lengths of pipe, the ends of which are squared and fitted with studs, screwed in as shown in the detail. All braces are of ½-in. pipe.

The table may be made of cast iron or built up, as desired. If a cast table is wanted, a pattern must be made. White pine or spruce, dressed down to a thickness of ⅝ in., should be used for this. A tapered flange is run around the underside as shown, to strengthen the table and keep it from warping. The two pivot lugs are then cut, shaped, and glued and tacked in place, and the inner corners of the flange filleted. This is a simple pattern to make, even if a patternmaker is not employed. When the casting is planed, the ends and sides should be surfaced as well as the top. If this is done, the table can be used as a laying-out plate for pattern or metal work. The saw slot is cut through the table with a ¼-in. slitting saw.



If a built-up table is preferred, sheets of good straight steel plate are cut and filed to width and fastened to an angle-iron frame with small flat-head screws. A short piece of narrow plate is fastened to the front of the table in line with the slot; the end of the elevating screw bears against this. The pivot lugs are made of 1½-in. angle iron, and fastened to the underside of the table with capscrews; the upper ends of the capscrews are cut off and riveted into countersinks in the table top, then filed or ground flat. The lugs are drilled a neat fit for the rear upper cross brace, and pivot directly on it. The guide, or fence, is made from a piece of flat stock, fitted with two parallel round bars. It is held in any desired position by means of a split double-slide bearing, which is fastened to the table by two flat-head machine screws driven into the lower half of the clamp from the underside of the table, as shown in the detail drawing. A knurled-head screw is used to clamp the two parts together. In assembling the machine care must be taken that the saw and guide are parallel.

The crosscut guide moves in a slot planed the length of the table, if the latter is made of cast iron, or cut through, if built up. In the latter case the slot is strengthened and a bottom formed for the groove by a length of plate or wide flat stock screwed to the underside. The guide is made from a flat piece of steel, 1 in. wide. To one end is fastened a swinging head, made from angle iron, which may be clamped at any angle by means of a stud and wingnut. With the aid of this guide, angles and miters can be cut, as well as square crosscuts. The guide is also used when cutting soft metals, such as brass or aluminum.

The elevating screw may be one taken from an old valve, or it can easily be made in the shop. It passes through a hole, drilled and tapped through the front upper cross brace.

The saw is driven by a 1⅜-in. belt, which may be run either in a slanting rearward direction to the motor or shaft, or vertically through slots cut in the bench. A ½-hp. motor is the most desirable form of power, although the drive may be taken from a countershaft, if necessary.

The 8-in. saws used can be purchased for both sawing metal and ripping and cutting off wood. The metal-cutting and crosscutting saws have fine teeth, while

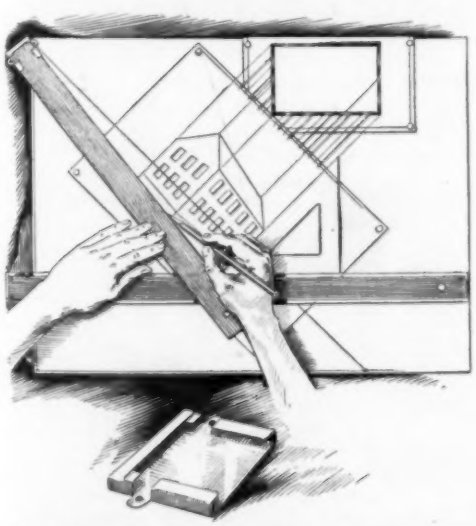
ripping saws have coarse teeth. This size of saw usually has a ⅞-in. hole and is 18 gauge in thickness, but thinner saws can be obtained if necessary. Saws 6 in. in diameter should be used for thin work.

The saws should be kept well filed and sharp, as a sharp saw makes good work and consumes less power than a dull one. A piece of work should never be pushed through the machine if the saw smokes, but the saw should be changed at once.

Making Perspective Drawings

While making a perspective drawing my straightedge slipped and the drawing, nearly finished, was ruined. To prevent such an accident from recurring, I made an attachment for the rule, by which it could be pivoted to the drawing board at either vanishing point. I cut a piece of tin from an empty tobacco box and bent it as shown in the detail to form a holder. This was fitted to the end of the straightedge and holes were punched in the tabs for pins. In use, a pin is driven into the board and the straightedge hooked over it allowing the ruler to be swung around without danger of getting it out of place at the pivot.

By arranging the drawing sheet at an angle, a smaller drawing board can be used and perspective work can be done



Straightedge, Pivoted at Vanishing Point, Eliminates Danger of Drawing Wrong Perspective Lines

much more easily than ordinarily, as it can be laid out from a plan as indicated, a triangle being used to draw the vertical lines of the building.—G. M. Beerbower, Tarrytown, N. Y.

Center-Punch Holder

Prick punching boiler plate or any sheet metal, is facilitated considerably by the fixture shown in the illustration, as this

Simple Center-Punch Holder Prevents Misplaced Punch Marks and Avoids Injury

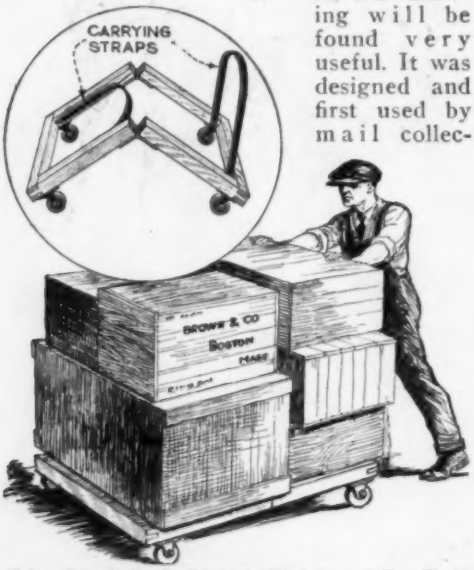
holds the punch securely on the work so that it cannot slip off the mark, and also eliminates the disagreeable experience of hitting one's fingers with a misdirected hammer blow. The holder consists of a length of flat spring steel bent over to a U-shape. A small piece of iron with a hole drilled through it for the center punch to fit in snugly, is riveted on the end of the holder. In use, the end of the holder is slipped under the work and the punch is brought down on it, the left hand being used to move the holder.—James E. Noble, Toronto, Can.

Sediment Bulb in Oil Burners

Kerosene burners for stoves and furnaces are becoming quite common, but, whether gravity or air-pressure fuel feed is employed, a sediment bulb, or similar receptacle, in the pipe line will prove a worth-while addition to the equipment. Sand, grit and water are present in much of the barreled kerosene sold, and as these impurities are heavier than the oil, they readily flow from the bottom of a tank through the feed pipe, and sooner or later will reach the burner and cause trouble. If a sediment bulb is placed between the tank and the burner, however, this foreign matter will accumulate there and may be drained off at intervals.—G. E. Hendrickson, Argyle, Wis.

Portable Folding Dolly

As an accessory for delivery trucks and wagons that handle bulky but fairly light boxes and bags, the folding dolly shown in the drawing will be found very useful. It was designed and first used by mail collectors and carriers of a large city in moving bulky bags in office buildings. It consists of a wooden frame, of 2 by 4-in. material, which is cut in half, as shown, and the two parts hinged together. Casters are provided at the corners and flat-iron handles are attached for carrying when folded. In this state it takes little room for storage.



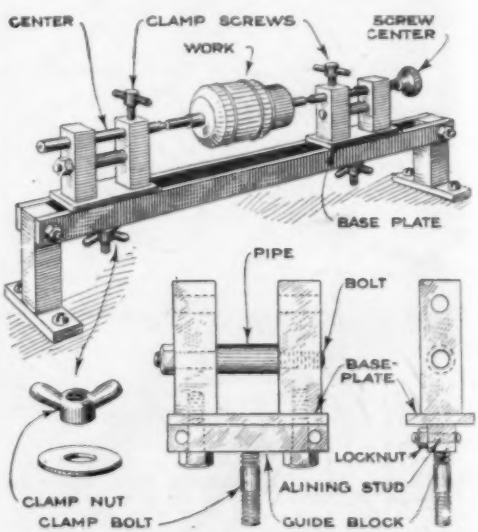
Collapsible Dolly Is Light in Weight and Can Easily Be Carried

Homemade Bench Centers

A set of bench centers is a convenience around any small shop or garage, for holding centered work not requiring to be driven, such as small motor or generator armatures, for soldering or rewinding; crankshafts for fitting bearings or testing for alinement or bars or pins while filing keyways. The drawing shows a bed with a pair of adjustable centers, one of them being a screw center, built up entirely from square, rectangular and round soft or cold-rolled steel, though, of course, any shop equipped for making patterns would prefer to use castings. For the amateur the arrangement shown will prove very satisfactory and may be built mostly by hand with the use of a small drill press, and a set of taps and dies.

The length of the bed depends upon the length of the bars used as well as the character of the work to be done between centers; the longer the bed and the more strain put upon the centers, the more liability there is of the bed springing sidewise. The two bars should be smooth cold-rolled steel carefully tested for straightness. They are clamped between two uprights of square stock, by means of capscrews and nuts, taking care that the top edges are in line. Two flat strips are screwed to the bottoms of the uprights and drilled for holding-down bolts.

Each center is built up of two square uprights, a base plate, a horizontal spacer bolt and sleeve, a guide block drilled for alining screws and a clamp bolt. The drawing shows the construction clearly so that little description is necessary. The base plates and guide blocks should be drilled a close fit for the bolts, to prevent shifting; dowel pins may be fitted if necessary. The alining screws are of such length that the center will move rather stiffly along the bed with no play whatever. The spacer sleeve is made from a length of iron pipe. One center is free to slide, as shown, and one end is pointed like a lathe center at 60° and the other cupped at the same angle. An extra center may be made and threaded to take a lathe chuck for holding uncentered work. The other center is threaded and screwed in and out somewhat like a tailstock in order to clamp the work tightly between centers. Both centers are provided with bolts extending through the bed, with plates and clamping nuts underneath.



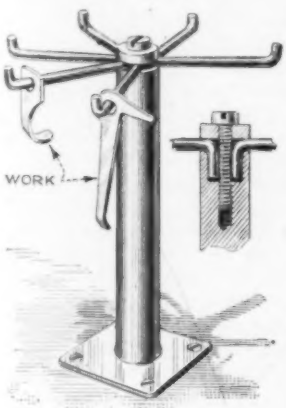
A Homemade Bench Centering Device for the Garage and Small Shop

Locknut for Small Pipe Connections

The small nut, which screws down on the bridge washer of a tire valve, fits a ⅛-in. pipe thread if screwed on well. This makes it possible to mount petcocks and small tubing connections on sheet metal. Such nuts are not so good as regular pipe locknuts, but are easier to obtain in small sizes. Often the nuts fit rather loosely on the threads and it is best to solder them on.—E. T. Gunderson, Humboldt, Iowa.

Drying Rack for Lacquered Work

The photo shows a convenient drying rack used by a jobbing brass shop for holding lacquered work. The special feature of this rack is that the hooks are adjustable sideways, which permits them to be moved around to accommodate any shape of work without the risk of the pieces rubbing against each other. The rack consists of a length of rod which is held vertically on a plate screwed to the bench. The top end of the rod is drilled and tapped for a screw, and a recess is drilled as shown to receive the ends of six hooks, which are made of lighter steel rod and bent to the shape shown. The hooks are held on the top of the rod by a washer and a flat-head screw, which is tightened sufficiently to hold the hooks securely without preventing them from being pushed sideways.—Harry Moore, Rosemount, Montreal, Can.



Drilling Holes in Doors

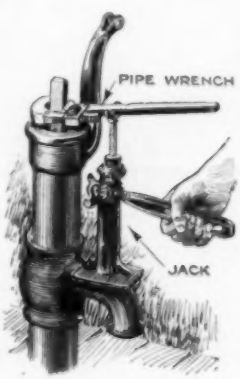
In interior-finishing jobs, where it is necessary to drill numerous holes in doors for locks or latches and corresponding holes in the door jambs, it has been found convenient to use a brace support of the kind shown in the drawing. It consists of a length of wood equal to the distance that the holes are to be drilled above the floor, so it can be set up against the door and the center of the hole marked, and

Support for Brace Aids in Drilling Holes in Doors

can then be used to steady the brace while drilling, a round notch being cut at the top to receive the brace. It holds the brace perfectly horizontal, thus permitting a hole to be drilled straight. The lower end of the stick is about 3 in. wide and cut to the radius of the length of the stick, so that the height of the drill does not change greatly as it is fed forward.—G. M. Beerbower, Tarrytown, N. Y.

Raising a Fallen Pump Rod

While overhauling a deep-well pump, a farmer lost hold of the suction rod and it was drawn down so far that only the end could be grasped. The suction was too great to allow the rod to be lifted by hand power; so the following method was resorted to. A pipe wrench was clamped over the projecting end of the rod and a small jack placed on the spout, as shown, a wedge or two of wood being used to give the jack a firm support. The jack was raised against the wrench and the rod was then readily brought up.—L. B. Robbins, Harwich, Mass.



Dusting Conduit with Soapstone

An electrician who formerly used a cumbersome air-pressure tank-and-hose outfit to force soapstone into conduit, found that the simple contrivance shown

Simple Method of Dusting Soapstone in Conduit to Prevent Wires from Sticking

herewith did the work equally well and with less trouble. Four rubber washers, cut to fit snugly inside of the conduit, were mounted on a ¼-in. eyebolt in the manner shown. After placing a quantity of soapstone in the open end of the conduit, with a knife blade or spatula, the drag tape and insulated wire were attached to the ends of the eyebolt as shown. The tape was pulled from the opposite end, the rubber washers being drawn through the pipe, and in this way the soapstone was forced along. As the soapstone gradually sifted past the washers, the conduit was sufficiently dusted to prevent the wire from sticking.

Cleaning Rusty Tools

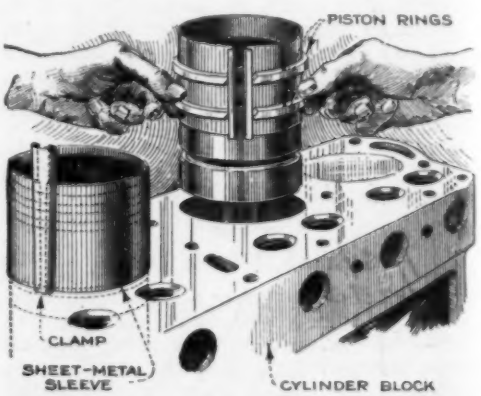
Take the lid of an ordinary round baking-powder can and partly fill it with a thick mixture of fine emery dust and light machine oil. Touch the emery mixture with an ordinary cork, kept handy for the purpose, and rub it over the surface of any slightly rusted tool or other article of steel. This will instantly remove the rust and leave a thin protecting film of oil.—James E. Noble, Toronto, Can.

Renewing Worn Files

Old files, which have become badly worn, can be renewed by immersing them in a solution consisting of six parts of water and one part of nitric acid for about five minutes. The file is then rubbed a few times over the edge of a block or table padded with about two or three thicknesses of cloth. This wipes the acid from the surface of the teeth but does not remove it from the spaces between them. The file is laid down for half an hour, which allows the acid to eat the grooves deeper; it is then thoroughly washed.

Ring and Piston-Fitting Tool

As a means of compressing piston rings when inserting the piston in the cylinder, or holding them expanded so that they can easily be slipped into the piston grooves, the simple fixture shown in the illustration will appeal to any automobile mechanic who has considerable work in overhauling engines. It can be made in a few moments from a rectangular piece of sheet iron. The two edges are turned outward and the piece then bent to conform to the curvature of the piston. A small tapered strip of the same material is cut and the edges bent inward to draw the ends of the sleeve together when it is pushed down over them. In use, the piston rings are first slipped over it as shown in the right-hand detail and can then easily be pushed over the edge into their respective grooves. After this has been done, the sleeve is clamped around the piston to compress the rings in the

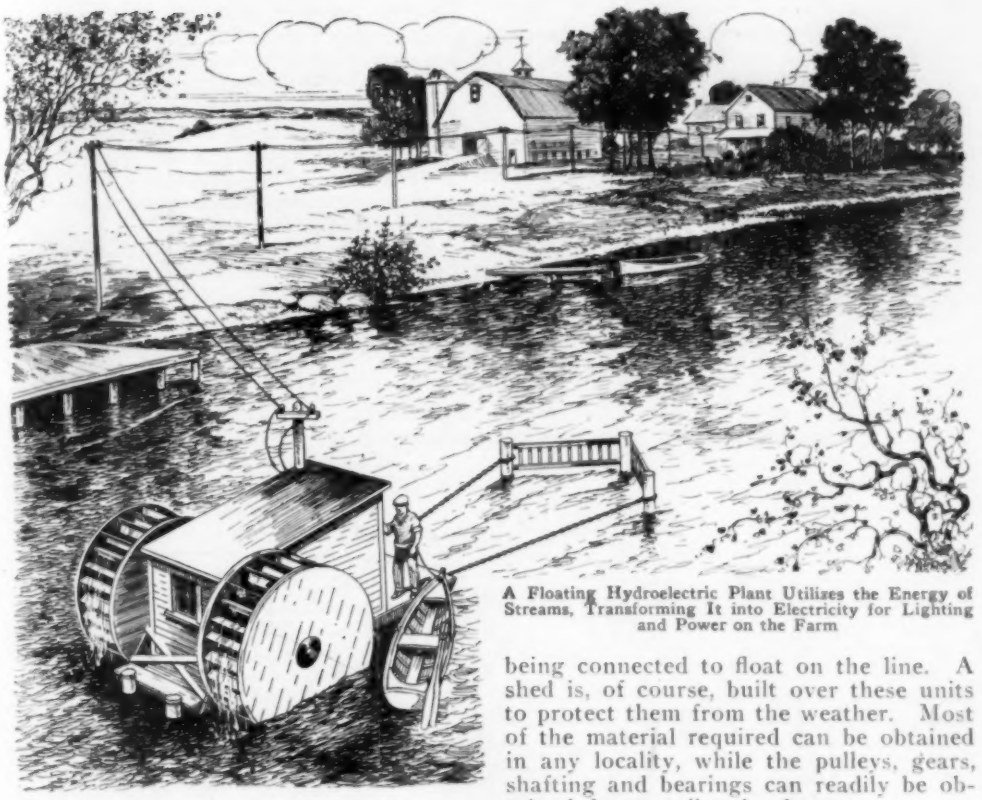


Sheet-Metal Sleeve Proves Useful in Assembling Piston Rings

grooves and hold them in this position while the piston is pushed into the cylinder.—G. A. Luers, Washington, D. C.

A Floating Hydroelectric Plant

By F. D. BURKE

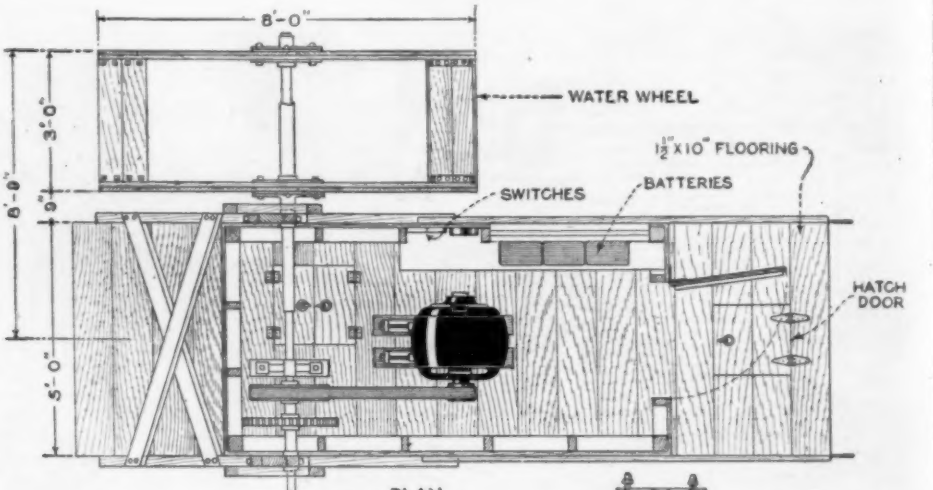


A Floating Hydroelectric Plant Utilizes the Energy of Streams, Transforming It into Electricity for Lighting and Power on the Farm

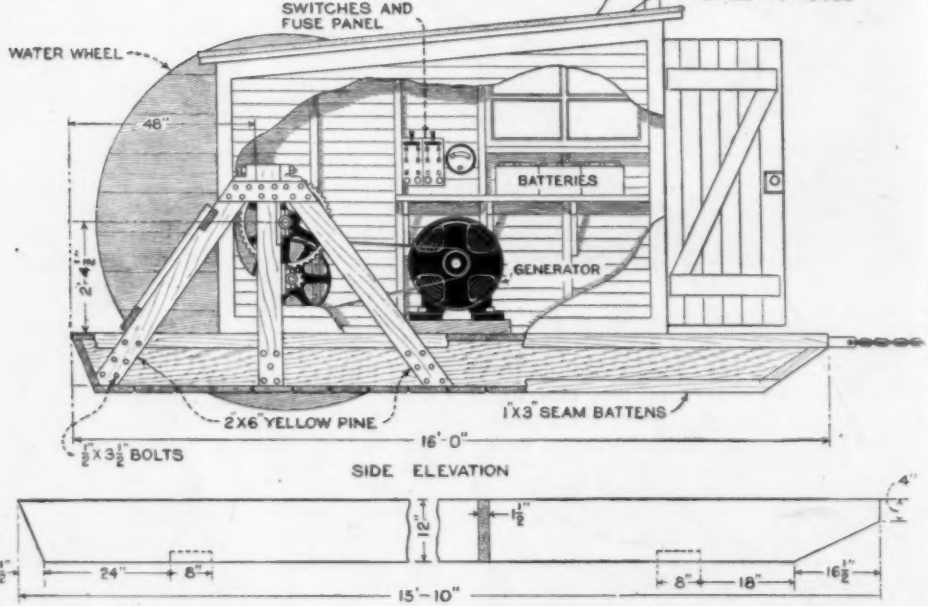
RURAL comforts can be greatly increased and much labor eliminated by transforming the energy available in thousands of small streams into electricity by means of a floating hydroelectric plant, which any enterprising farmer can easily build. The advantages of such a plant are quite obvious; it is the only logical installation where the slope of the land does not permit the construction of a dam, and by eliminating a dam with its associated features, such as a flume, turbine, power-house foundations and other concrete work, the cost of the installation is kept down considerably. Furthermore, a floating power plant is quite independent of shifting water levels.

The plant consists of two water wheels, mounted on a heavy shaft and supported on a scow, which is held at anchor in the stream. The generator, which is the heart of the outfit, is run from a countershaft connected to the main shaft by gears and pulleys. The electricity is stored in six automobile storage batteries, or it may be supplied directly to the lines, the batteries being connected to float on the line. A shed is, of course, built over these units to protect them from the weather. Most of the material required can be obtained in any locality, while the pulleys, gears, shafting and bearings can readily be obtained from mail-order houses.

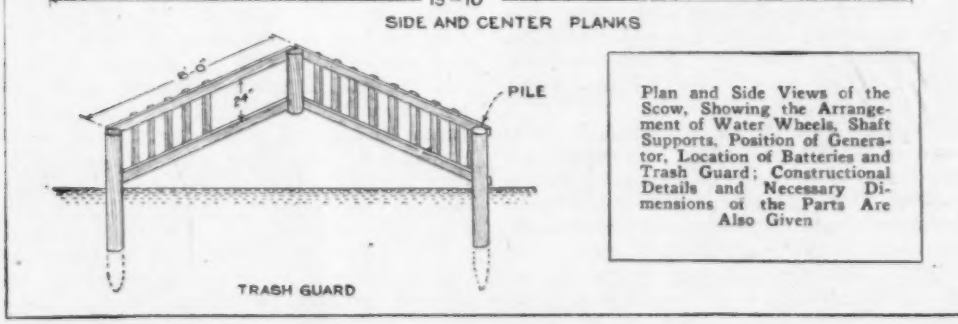
Yellow pine or cypress is used for the scow, the water wheels and their supports. The scow is 16 ft. long, 5 ft. wide and has a 12-in. draft. The builder should begin with the side and center planks, which are cut to the shape and size shown in the drawing from 1½-in. stock, straight-grained and reasonably free from knots. Notches are cut in the under edge of the center plank at the points indicated so that any water that may get into the hull will circulate freely and prevent unbalance. After the side and center planks are cut, they are laid, with their upper edges down and properly spaced, on a level surface, and are held in this position by means of a piece of 1½-in. stock, 12 in. wide, nailed across the stern, and a piece 4 in. wide across the bow. The bottom planking is then applied. It consists of 1½ by 10-in. lumber and 16-penny galvanized nails are used to fasten it down. The edge of each plank should be given a 1/16-in. bevel so that a narrow V-shaped groove will be formed between adjacent planks. The planks are nailed on so that these grooves



PLAN



SIDE ELEVATION



SIDE AND CENTER PLANKS

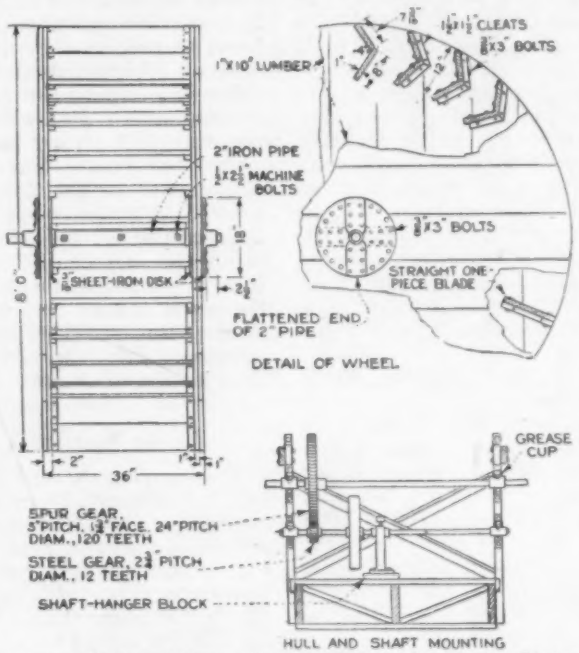
TRASH GUARD

Plan and Side Views of the Scow, Showing the Arrangement of Water Wheels, Shaft Supports, Position of Generator, Location of Batteries and Trash Guard; Constructional Details and Necessary Dimensions of the Parts Are Also Given

come on the outside, permitting them to be calked with cotton wicking. This is forced into the grooves tightly with a putty knife or a thin hardwood wedge, and one or two coats of well thinned white or red lead are then smeared in.

After the bottom has been completed, the hull is turned over and 2-in reinforcing strips, beveled with a plane and coated with white lead, are nailed over the joints at the lower edges of the end and bottom planks. This greatly increases the strength and helps to make the joints water-tight. Diagonal braces are then nailed inside of the hull at the center, bow and stern; the center ones are shown in the detail of the hull and shaft mounting. The inside of the hull should be given several coats of water-resisting paint. The supports for the water wheels are bolted to the sides of the scow on the outside, which must, of course, be done before the deck boards are nailed down. Each of these supports consists of an upright and two diagonal braces of 2 by 6-in. material. The transverse braces fastened to the rear diagonals, shown in the deck plan, need not be put on until the deck has been planked. Two flat-iron chain brackets are bolted to the side planks, at the bow, on the inside, after which the deck planking may be applied. The edges of the deck planks need not be water-tight, although this is preferable. They should, however, be nailed together tightly. The underside and the edges of the deck planks should be given a coat of paint before they are nailed down. Two small hatch doors should be provided, one at each end of the scow; these are necessary to permit inspection of the interior of the hull and occasionally for bailing out water that may have seeped in. By leaving them open there will be sufficient ventilation in the hull to dry it out thoroughly. Seam battens should be nailed along the top and bottom edges of the scow, over the ends of the planking. It is a good idea to give the inner surface of these battens a heavy coating of white lead and nail them down while wet.

The two water wheels are 8 ft. in diameter, 3 ft. wide and are provided with 25 blades each, uniformly spaced. They may be straight or trough-shaped, as shown in the detail of the wheel construction. The former are simpler to make but the latter are more efficient. The sides of the wheels are made up of two layers of 1-in. stock toenailed to each other at right angles. Sheet-iron disks are used to reinforce the centers on the outside. Before assembling the wheels, the exact location of each blade must be carefully marked on the sides; wooden cleats are bolted or screwed on at these points, and the blades are then bolted to the cleats. A hub is provided on each wheel; this is made of three lengths of 2-in. iron pipe, one length fitting inside and two short lengths on the outside; the ends of these lengths are split open for about 18 in., flattened and then bent over at right angles to permit fastening them to the sides, holes being drilled through the flattened ends to receive bolts with which they are attached. If large floor flanges are obtainable, it is better to use a single length of pipe instead of three short lengths for the hub, and then thread the ends to permit the flanges to be screwed on, four flanges being used on each wheel. One is screwed tightly against each side of the wheel and they are then bolted together. The completed wheels are mounted on a 2-in. steel shaft, held in



Details of Water Wheels, Showing Method of Attaching Blades and Hubs; Lower Detail Shows Arrangement of Shaft, Gears, Pulley and Cross Section of Hull

suitable bearings, which are securely bolted to the upright members of the supports, previously described. The shaft runs clear through the hubs of the water wheels and these are bolted to it. A 24-in. pitch-diameter steel spur gear with a 1¾-in. face is keyed to the shaft as indicated in the detail. This must be done before the water wheels are bolted on. A countershaft is mounted in bearings similarly bolted to the end supports, and a small steel gear of 2¾-in. pitch diameter is keyed to the countershaft to mesh with the gear on the main shaft. The diameter of the countershaft will be limited by the small gear, and may be 1½ in. or less. The ratio of the gears should be about 10 to 1. To prevent the countershaft from whipping, an additional bearing, held in an ordinary overhead shaft hanger, is provided at the center, the hanger being securely screwed down to the deck. Large self-feeding grease cups must be provided on all the bearings, as the equipment is to be used for long periods at a time with little attention. A 22-in. cast-iron pulley with a 3-in. face is mounted on the countershaft near the center and is belted to a 3-in. pulley on the generator, which is bolted to the floor.

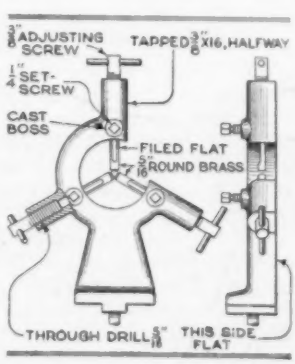
The generator should be of the 32-volt type, having an output of 2 kilowatts, which is approximately the amount of power developed by the plant floating in a stream having a velocity of four miles per hour. The generator should produce this amount of energy at a speed of 700 to 1,000 r.p.m. No other kind of generator will give satisfactory results for this purpose, and therefore care must be taken to give the correct specifications when ordering it. The generator should be mounted in such a manner that it can be slid toward and away from the shaft, to permit tightening of the belt or its removal from the pulley, which is done when the generator is not used. Other methods of keeping the plant at rest are to fasten the water wheels to the deck with large iron hooks, or to provide means for shifting the gears out of engagement.

Six 6-volt automobile storage batteries, or 16 cells of a farm-lighting battery, are mounted on a rigid bench made of 2-in. material. The batteries are connected in series, the open leads being connected to a single-throw knife switch, provided with 15-amp. screw fuses. The generator leads are connected to the other side of the switch. The house wires are also connected to the same terminals, but are run through a similar switch to permit disconnecting them when desired. An ammeter may be connected in the line to the batteries and the switches and ammeter can be conveniently mounted on a wooden panel. Six 6-volt batteries will give a potential of 36 volts, which is a trifle too much for 32-volt lamps, but this will be taken care of by the resistance of the lines to the house, which will cause sufficient drop in voltage.

The entire plant is housed in a small cabin or shed built on the deck. The scow should be securely anchored with the bow facing upstream. If the blades are not submerged sufficiently the scow should be ballasted as much as necessary. It is advisable to provide a trash guard in front to protect the wheels from floating debris. The guard consists of three piles driven down into the stream bed and extending about 2 ft. above the surface of the water. A strong fence can readily be nailed to them. The guard should be considerably wider than the width of the scow and water wheels, and the lower edge of the fence should be at least 2 ft. below the surface of the water. The piles form an excellent mooring place to which the scow can be tied with heavy chains, hooks being provided on the piles for this purpose. The scow should be moored as close to the piles as practicable.

Steady Rest for a Small Lathe

The drawing shows an easily built open-type steady rest that was originally designed for a bench speed lathe but which will fit almost any small lathe. There is but one pattern required, and this is of the one-piece type, with no cores or loose pieces. If more than one casting is to be made from it, the pattern should be built up of two ⅜-in. pieces of lumber, with the grain crossing at right angles to prevent the pattern from splitting while being rapped in the mold. The pieces are glued together and reinforced by three small screws through the setscrew bosses, thus holding everything firmly together. After the casting is obtained, the lower part of the base may be finished by hand filing or it can be ma-

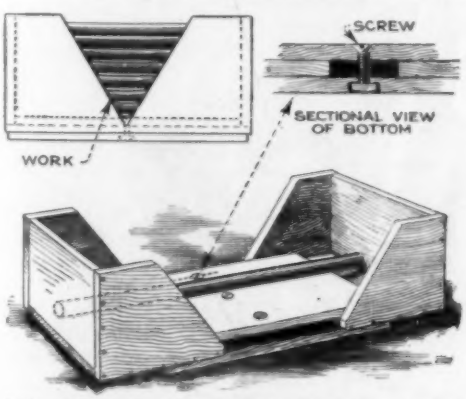


chined in a planer or shaper. Then, three 5/16-in. holes are to be drilled through the arms. As this drilling should be accurately done, it would be best to turn up a hardwood or metal collar to fit the circular opening of the body casting, this collar being centrally drilled for a bolt to secure the work to an angle plate. Then, without moving the angle plate, the casting may be rotated until each arm is drilled. Next, all three holes are tapped halfway through with a 3/8-in. 16-thread tap for the adjusting screws.

Three arms are sawed from a 5/16-in. brass or bronze rod and a flat is filed on one side of each, this flat being engaged by the point of a 1/4-in. setscrew tapped through the side boss so that the brass arm may be clamped in position as well as prevented from turning. The adjusting screws may be ordinary 3/8-in. machine bolts, long capscrews or made up from cold-rolled stock, fitted with cross handles.

Extension Box Holds Finished Work

Work that comes in short, straight lengths, such as tubes, angles, strips, etc., can be conveniently held in an extension box of the kind shown in the illustration. It consists of two movable endpieces which slide in the space between a double bottom, permitting adjustment for work of different lengths. The two bottoms are held together with three screws and nuts. To extend or reduce the length of the box the screws are loosened, the endpieces slid out or in as far as necessary, and the screws



Adjustable Extension Box Holds Many Sizes of Polished Work

tightened, causing the bottom to hold the endpieces securely. These boxes are especially useful in plating plants and other shops where finely finished work of this type is produced.

Small Homemade Pile Driver

The small pile driver shown in the illustration was successfully used by a Michigan bridge contractor to drive sheet piling. The hammer is an ordinary

Small Homemade Pile Driver Used by Bridge Contractor Saves Considerable Expense

garage-door weight, hung between two 2 by 10-in. planks about 16 ft. long. Pieces of flat iron are bolted to the weight and allowed to project on each side as guides to keep the hammer between the planks. A 1-in. rope is strung over the pile-driver block and snubbed around the pulley of a gasoline engine. In use, the operator grasps the free end of the rope and by drawing it tight, as the engine is started, raises the hammer. Then he releases his grip on the rope, allowing it to slip around the pulley, and the hammer falls with considerable force upon the pile. This outfit was assembled at small cost. An average of 40 piles per eight-hour day were driven by two men with it, and this meant quite a saving in expense, considering the cost of installing and operating a regular pile driver.—Paul L. Fetherston, Jackson, Michigan.

¶To blacken aluminum clean it thoroughly and apply a mixture of the following chemicals: sulphate of iron, 1 oz.; white arsenic (poison), 1 oz.; hydrochloric acid, 10 oz., and water, 12 ounces.

Concrete Mixer Made from Mower and Water Tank

When building a concrete silo two farmers improvised the novel concrete mixer shown in the photo. The pole, seat, levers and one wheel of a mowing machine were removed, and the remaining part of the mechanism was mounted on a wooden frame so that the wheel was held in a tilting position. A galvanized-iron water tank was then clamped to a wooden cross made of heavy material, and this was in turn attached to the mower wheel as indicated. A pulley was provided on the driving shaft of the mower so that it could be run by a belt connected to a small gasoline engine. In this way an efficient concrete mixer was provided.—R. S. Williams, Chicago, Ill.

Novel Concrete Mixer Made from Mower and Circular Water Tank

Paring and Burning Soils

Paring and burning soils is a method of improvement accomplished by turning up a thin layer of the surface, which consists mainly of stubble, roots, and humus, allowing this layer to dry thoroughly and then burning it.

This treatment is particularly beneficial for soils that contain a large amount of organic matter, as it makes them crumbly. Another benefit is that it greatly increases their fertility; the organic matter is reduced to ashes, which, upon being dissolved by acids and water in the soil, become available to the plants as food. However, as the nitrogen in the organic matter is lost by burning, soils poor in nitrogen should never be so treated. Peat soils have so large a quantity of nitrogen that much of it may be lost without destroying their fertility.

Burning also will clear marshes of matter that must either be left to decay or must be cleared away before the marsh can be cultivated. Where a deep growth of sphagnum moss occurs, which makes plowing impossible, the most practical method of removing this is by burning. This can best be done during the dry summer months, as July and August, but in so doing great care must be taken to prevent the fire from spreading and from burning into the soil too deeply, a danger that exists in marshes where the water level is low. Stiff clay soils can also be improved considerably by burning, but as these soils usually do not contain enough organic matter to supply fuel for burning, the fuel in form of brush, peat, or whatever material is available, is distributed over the surface and burned. The benefit of burning clay soils is that it destroys their cohesive character to a great extent, making them more similar to sandy soils, with the result that air and water can circulate through them much more freely, and this makes tillage operations easier.

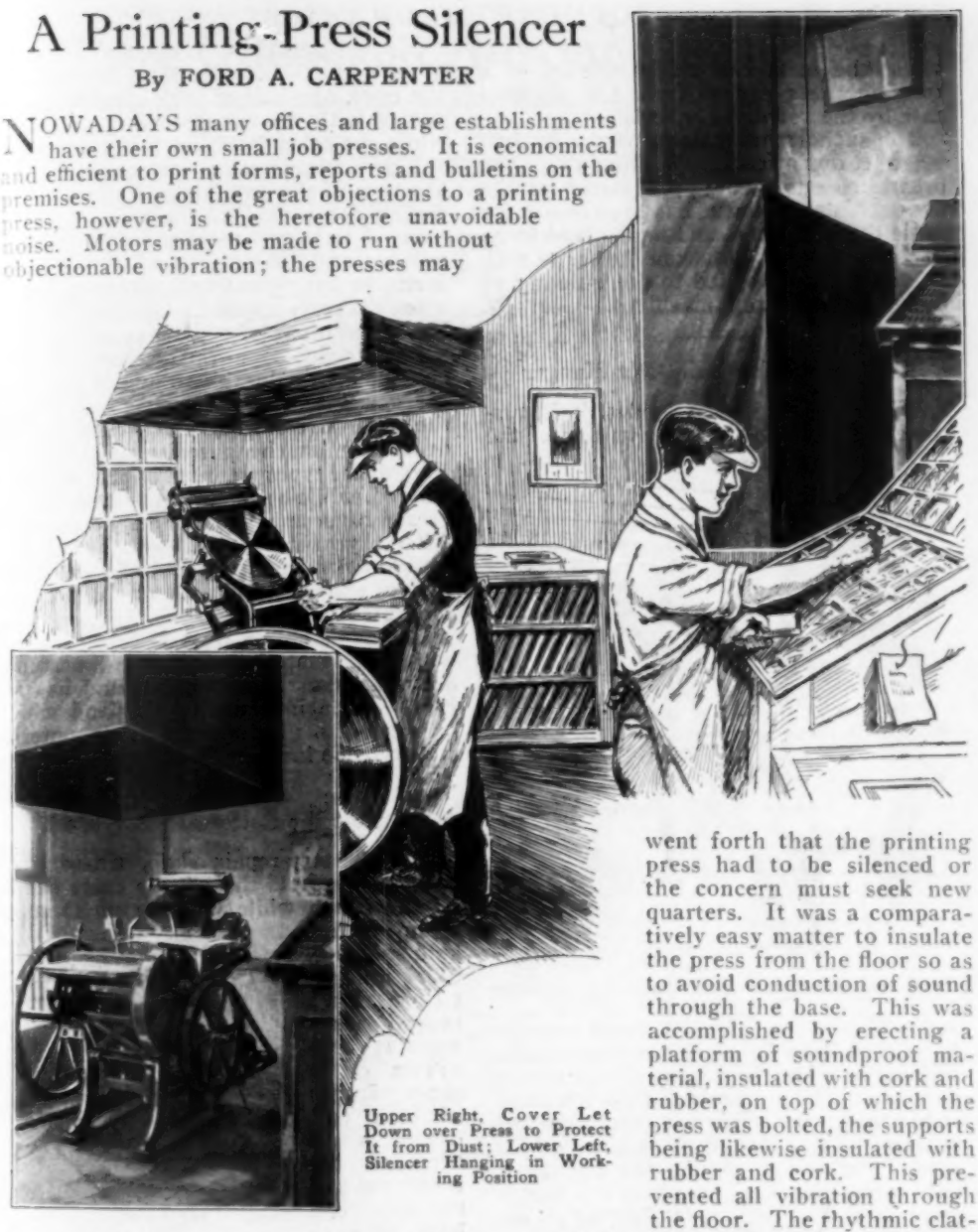
Keeping Wood-Turning Chisels Sharp

Wood-turning tools, especially those used on softer woods, require frequent sharpening. Not only can time be saved, but a keener edge also kept if the slightly dull chisel is held for a moment at the proper angle against the inside of the driving belt of the lathe, as shown. Both faces of a chisel are applied alternately to the moving belt. In the case of a gouge, the inside is first placed against the edge of the belt and then the outside touched up in the same way as the chisel. The troublesome burr left on tools after grinding or stoning can be instantly removed by this method.—D. Allis, Asbury Grove, Mass.

A Printing-Press Silencer

By FORD A. CARPENTER

NOWADAYS many offices and large establishments have their own small job presses. It is economical and efficient to print forms, reports and bulletins on the premises. One of the great objections to a printing press, however, is the heretofore unavoidable noise. Motors may be made to run without objectionable vibration; the presses may be insulated from the floor, but the clank of the inking roller over the plate and the banging of the cams make a racket that prohibits the use of a press in a first-class office building.



Upper Right, Cover Let Down over Press to Protect It from Dust; Lower Left, Silencer Hanging in Working Position

Several years ago the writer was confronted with this problem. It was absolutely necessary to do the printing next to the main office of the business concern, which was located on one of the floors of an office building tenanted by professional people. It was the only printing press in the twelve-story building and the edict went forth that the printing press had to be silenced or the concern must seek new quarters. It was a comparatively easy matter to insulate the press from the floor so as to avoid conduction of sound through the base. This was accomplished by erecting a platform of soundproof material, insulated with cork and rubber, on top of which the press was bolted, the supports being likewise insulated with rubber and cork. This prevented all vibration through the floor. The rhythmic clatter of the press still persisting, experiments looking toward absorption of the sound were made. After months of trial, it was found that a boxlike structure of heavy canvas, stretched over an iron-rod frame and hung from the ceiling just above the head of the pressman, absorbed practically all of the sound caused by the operation of the printing press. With the press running full speed, the sound was so deadened by this simple silencer that it was unnecessary to keep the doors to the adjoining rooms closed. People passing

along the halls had no knowledge of a running press except from the shadows cast by the revolving wheels.

The silencer has another virtue in that, when let down from its position above the press, it forms a dust-proof cover for the press. This apparatus has been in use for more than ten years and has proved to be of great utility. The same principle may be successfully applied to the quieting of other noise-making machines.

Self-Tightening Paint-Pot Hanger

When painting on a ladder, it is customary to use a wire hook on one of the

Handy Paint-Pot Hanger Is Self-Tightening on Ladder

rungs to hold the paint pot, but it is much handier to have the paint pot on the right side of the ladder, held by a self-tightening hanger of the kind shown in the drawing. It can readily be swung open and loosened so that it can be shifted up or down as desired. Pushing or pulling the arm down only causes the hanger to grip the ladder more firmly. The arm is notched to receive the bail of the paint pot, and the weight of the pot keeps the hanger securely clamped to the ladder—C. Homewood, Ontario, Calif.

Paraffin Waterproofs Stone

The superiority of paraffin treatments for waterproofing stone has been demonstrated by a weathering test of colorless waterproofing compounds conducted at the bureau of standards during the past three years. Samples of Indiana limestone and of sandstone have been used in the tests, one-half of each specimen being coated with the waterproofing compound while the other half was left untreated.

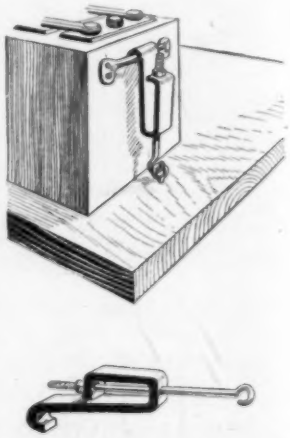
Very little deterioration was noticed in the case of the paraffin-treated specimens during the period of the test. Coatings using aluminum stearate, and mixtures of paraffin and Chinese wood oil were also found to have good waterproofing values when properly applied. Coatings consisting of solutions of glue, magnesium fluosilicate, cellulose nitrate, resins, etc., are not sufficiently durable to justify their use.

Most of the materials tried discolored the stone to a considerable extent at first, depending on the porosity of the stone. Very dense types were not appreciably discolored, while very porous ones appeared greasy for several months after treatment. After a year or more of weathering, the discoloration disappeared and the treated surface appeared lighter and cleaner than the untreated.

A new series of tests is being started with these materials on dense limestones and marbles. A new compound has recently come into use in England which consists of a silicon ester. This material is also to be included in the tests.

Clamps for Battery-Repair Work

In a battery-repair shop, where it is necessary to hold the battery cases firmly on the bench while working on them, a clamp of the kind shown in the illustration has proved useful. It consists of a short length of iron rod, one end threaded to take a nut and the other end bent over to form a hook to engage with a screw-eye, which is driven in the bench top. A short length of flat iron is bent to the shape indicated and two holes are drilled through it to receive the straight part of the hook. The curved end is slipped over the handle or edge of the battery and the nut is turned down until the clamp is sufficiently tight to hold the battery securely.



Prize Offers and Announcements

$500—Bait for Rat Poison

We have perfected and patented a new chemical composition based on cyanide, the smallest particle of which in a rat's stomach will cause the animal's instant death. By the use of this poison rats die within a foot or two of where they eat it. We desire to market this poison already prepared, so that the user has simply to spread the poisoned bait in infested areas. The bait should be a neutral one, that is, neither acid nor alkaline, and of such a nature that it can be manufactured in small particles about the size of a grain of wheat, so the rat will be tempted to eat them where he finds them instead of carrying them away. What is required is a bait, filler, or carrier which will have either an odor or food appeal sufficient to impel rats to eat it, even in the presence of other food. It should be a bait or food which rats will prefer to any other that would ordinarily be available. For a satisfactory formula, or bait combination for the poison that passes our tests, this concern will pay the sum of $500 in cash. This offer is good for one year from November 1, 1924. Address American Chemical Works, 720 Washington Avenue, Minneapolis, Minnesota.

$300—Hand-Printing Press

The sum of $300 in cash and royalties will be paid for a satisfactory design and drawings of a simple self-inking hand-operated printing press by this donor. The press should be six by nine inches in size and one which can be manufactured from cast iron at a cost not exceeding $25. All designs submitted must of course meet the requirements of the donor before being considered for adoption. Address all matter to C. L. Whitfield, 429 East Bute Street, Norfolk, Virginia. May 1, 1925, is the closing date for this offer.

$25—New Uses for Cel-o-Glass

The sum of $25 will be paid by Cello Products Incorporated for each suggested new use for its product, Cel-o-Glass, provided said use is of such character as to open up an entirely new and definitely accessible market for the sale of this adaptable material. Entries will be judged by the company alone. In case of duplication of suggestions, preference will be given to the one first received. List of present uses and other information can be had from the donor. Address all replies to Cello Products Incorporated, Box 28, 89 Fulton Street, New York, N. Y.

PREVIOUSLY ANNOUNCED

ALL OFFERS CLOSE MAY 1, 1925

FOR THE BEST SUGGESTED IMPROVEment on a gasoline-heated blowtorch and soldering and branding iron combined an award of $500 will be paid by the Everhot Manufacturing Company.

AWARDS OF $500 EACH WILL BE PAID for a waterproofing process for a library paste and a method that will produce increased sales of this product. John J. Harris and Company.

$2,000 WILL BE PAID BY THE NORTH Shore Food Products Company for a method of processing or preserving cottage cheese to keep it fresh for at least two weeks.

THE CARR FASTENER COMPANY WILL pay $500 for a reservoir grease cup which can be filled with a grease gun and feed out the grease at a slow rate.

FOR NEW WAYS OF USING BUTTON molds $500 will be paid by donor in Problem HA-1, and the same concern will pay $500 for new uses for button-mold machines as stated in Problem HA-2.

THE SUM OF $50 IS OFFERED BY THE Parsons Manufacturing Company for the best plan they receive for uses of ground slate.

TO THE PERSON SUBMITTING TO THEM an article which they can make in their machine and electrical shop, the Guyan Machine Shops will pay $250 over and above its royalties or sales price.

GRANITE STATE MOWING MACHINE COMpany offers $500 in cash and royalties for satisfactory working drawings for gasoline-motor lawn mower they accept for manufacture and marketing.

NATIONAL BRASS COMPANY WILL PAY $300 for design of key guide that can be made of sheet metal and which will properly fit escutcheon plate of similar material.

TO ANYONE WHO WILL PRODUCE FOR them a saxophone reed to satisfactorily replace the present reed, the Buescher Band Instrument Company will pay the sum of $1,000.

THE PHENIX RADIO CORPORATION WILL pay the sum of $1,000 for the design of a new form of condenser for radio reception.

FOR A SATISFACTORY HAMMER-BLOW arrangement for a portable hammer drill, the Wodack Electric Tool Corporation will pay the sum of $500.

$2,000 WILL BE PAID IN SEVERAL AWARDS for processes and machines for salvaging waste lumber. National Lumber Manufacturers' Association.

FOR SKYROCKET STICK HARMLESS IN descent, $1,000; bombshell with illuminated flag, $250; chemical combinations to produce smokeless fireworks colors, $250. Thearle-Duffield Fireworks Company.

MOTOR-OPERATED HANDSAW FOR MANUfacture and sales; award, $10,000 in royalties. R. L. Barker and Company.

ELECTRIC HEATING ELEMENT WHICH will operate and interchange with base and cover of Imperial self-heating gasoline iron, $500. Imperial Brass Company.

DISCOVERY OF NEW USES FOR CARBONdioxide gas or improvements to present uses. Award $1,000.

FOR A SIMPLE DESIGN OF A 2-KW. MOTOR generator set, or rotary converter and one which this concern will accept, the William H. Mitchell Company will pay $500.

THE GEMCO MANUFACTURING COMPANY will pay $250 for suitable article they can make in their general metal-working plant.

DONOR IN PROBLEM PD-1 DESIRES A DEsign for a starting switch for an alternating-current motor and will pay $100 for the one accepted.

THE BENJAMIN ELECTRIC MFG. COMPANY will pay $250 for fitting stand lamp clusters to old vases; $150 for most practical method of using electric shop materials for lamp stands and $100 for business boosting scheme.

FOR ACCEPTED IDEAS FOR NEW USES OF fans, blowers, shutters, and unit heaters Ilg Electric Ventilating Company offers $5,000 in various awards.

$500 FOR SALES PROMOTION PLAN FOR absorbent, non-heat-conducting powder that can be used with other materials. The Keasby and Mattison Company.

NATIONAL SLATE ASSOCIATION WILL pay $200 for best suggested new use for slate; other accepted suggestions paid for in proportion to value.

WILLIAM H. MITCHELL COMPANY WILL pay $500 for three new uses suggested for low-voltage generators which they adopt as part of sales plan.

Full Details Regarding the Previous Offers Listed Above, May Be Obtained by Addressing the Bureau of Information, Popular Mechanics Magazine

MARCONI ON RADIO

Radio Questions and Answers

Question. Will an indoor antenna, 75 ft. long, in a frame building give as good results as an outdoor antenna? **Answer.** No indoor antenna is as good as an outdoor one, but with a tube set, if the antenna is well insulated from walls and does not run parallel with electric-light wires, it will often give good results.

Q. Does rain pipe make a good ground and is it safe? Is B-battery current running through the set when A-battery rheostat is turned off and B-battery terminals are not disconnected? **A.** Rain pipe is a poor ground. B-battery current is not consumed unless the tube is lit.

Q. When tuning outside stations with my set, if I hold my hand at a certain distance from the condenser or over it, the signals become louder, and when I remove my hand, they fade. The same thing happens on the variable grid leak, the taps and coil. Is there something wrong with the hook-up or don't I tune right? **A.** Your trouble is caused by body capacity, and to eliminate it, a shield should be placed between the 23-plate condenser and the panel. This should be connected to the ground, but insulated from the mounting shaft and the screws of the variable condenser.

Q. My B-batteries, which are the ordinary block type, are run down, and, as it is 15 miles to town, I would like to know of some way of renewing them. Can you tell me if this can be done? **A.** We do not know of any practical way of renewing worn-out B-batteries, and, even if they could be given a little extra life, the result would probably not justify the trouble.

Q. Must the paint be scraped off a water pipe before the ground wire is clamped or soldered to it? One of my friends has a wire simply wrapped around the pipe and he gets very good results. **A.** Some paints are fairly good conductors, and it happens that your friend has a pipe that is coated with such a paint. However, no ground that is formed merely by wrapping a wire around a pipe, painted or unpainted, is really a good one. A good ground is a very important item of the radio installation, and to make a satisfactory job it is essential that the wire be fastened to the clean metal of the pipe, either by soldering or by means of a copper ground clamp.

Q. Can an inside aerial be used with a crystal set for local stations? **A.** Some crystal sets work all right with an inside antenna and others do not. You will find that two or more turns of bell wire run around the picture molding of the room will do, if an inside aerial will work at all.

Q. Can I empty my storage battery, wash it out and leave it for five months or so without injury to it? **A.** Yes. A good method is to give the battery a charge before removing the acid, which should be kept tightly corked in a glass bottle. All that is necessary to put the battery in service again is to replace the acid and recharge.

Q. I have a three-tube radio receiver with storage batteries. Is it necessary to connect a lightning arrester to the batteries? **A.** In any properly installed set, a lightning arrester must be used in the aerial circuit between the aerial and the outside ground connection; it has nothing to do with the batteries.

Q. Can I use a UV-201A tube in an amplifier when the detector tube is a UV-199? **A.** This would not be practical, as the UV-201A is a 5-volt tube and the UV-199 a 3-volt tube. This would necessitate two A-batteries. It is always well to use the same type of tube throughout the set.

Q. With a three-tube receiver I have just constructed, I get good results on the detector tube but a constant singing noise with the first and second stages of the amplifier. Where is the trouble? **A.** Perhaps the tubes and amplifiers are mounted too close together. If space is limited, it is best to mount the amplifying transformers at right angles to each other. Possibly you are not using enough plate voltage on the amplifier tubes. You should try using a B-battery of 90 volts with these tubes.

Q. Is a long aerial good for distance? Mine is 75 ft. with a lead-in of about 30 ft. **A.** A long aerial is best for long-distance reception, but it may make your set tune broadly, if you are near high-powered stations. Long aerials also give louder signals, while the shorter ones are best for selective tuning and are preferred in congested radio districts.

Q. I wish to use plate glass for the panel of my receiver. Can you advise me how to drill the holes? **A.** A good way is to use a pointed piece of carborundum as a grinding tool with frequent applications of turpentine to facilitate quick drilling.

Q. How can I test the polarity of the wires leading from my charger to the battery? The charger is a homemade one, and the person who built it did not mark the leads. **A.** The simplest way is to dissolve a little salt in a glass of water, turn on the current, and dip the ends of the wires into the solution, being careful to keep them at least ½ in. apart. The negative wire will "gas" freely, that is, a constant stream of bubbles will be discharged from it. The wires can then be marked. If the line current is taken through a screw plug, it will not be necessary to mark this, provided it is not separable, but if the plug is a two-pole unit or is a separable one, it will be necessary to mark the position of the two halves. If the plug is not marked the charging current may become reversed.

Q. How does one know if a radio storage battery is fully charged or in what condition it may happen to be? **A.** The condition of charge of a storage battery is tested by means of a hydrometer. This instrument may be obtained at any radio shop, together with instructions for its use.

Q. My outside aerial has two parallel wires, each 45 ft. long, and a lead-in of 15 ft. If I added another 45-ft. wire, how long an effective aerial would I have? **A.** Your effective aerial length would still be 45 ft. The best aerial for general use is a single wire in a straight line, 100 ft. long and from 25 to 50 ft. above the ground.

Q. I am using two aerials on my one-tube set, one as the aerial proper and the other connected to the ground binding post. Will this extra aerial rebroadcast what I receive? **A.** The effect is to make a counterpoise, and will be no worse as far as reradiation is concerned than the common arrangement if a regenerative set is used.

Q. Can I use alternating current with a C-300 detector tube by stepping down 110-volt alternating current through a suitable transformer? **A.** It is impractical to use alternating current for lighting the filament of detector tubes in radio sets in this way, unless proper filters and chokes are used, with some means of rectifying the current.

Q. Can I use a loud speaker on a crystal set? **A.** Not on the crystal receiver alone; it will be necessary to add two steps of audio-frequency amplification for good results.

The Radio Department is willing and anxious to serve you. If you contemplate buying or building a set, we will be glad to advise you in selecting the proper instrument to suit your purpose, furnish you a circuit, or tell you where to get the best parts. When you run into trouble in building or operating your set, tell us about it, and we will endeavor to clear it up for you.

Address all inquiries to the Radio Editor, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.